Mai

OHIO STATE UNIVERSITY
FEB 22 1980
LIBRARY

Depository
RECEIVED
FEB 22 1980
O.S.U. LIBRARIES

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 2
JANUARY 15, 1980

W80-00401 – W80-00800
CODEN: SWRABW

TC1
545

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

SWRA is available to Federal agencies and their contractors or grantees in water resources research upon request, citing contract or grant number and sponsoring agency. Write: Office of Water Research and Technology, U.S. Department of the Interior, Washington, DC 20240. The **SWRA Journal** is also available on subscription from NTIS, 5285 Port Royal Road, Springfield, VA 22161. Annual subscription rates for the North American Continent are: Journal only, $75; Journal and Annual Indexes, $100; Indexes only, $50. Other addressees, write for prices.

Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is printed on the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 2
JANUARY 15, 1980

W80-00401 -- W80-00800

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

CONTENTS

FOREWORD iii

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

TILLAMOOK BAY ENTRANCE REFRACTION STUDY, TILLAMOOK, OREGON,
Army Engineer Waterway Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8A.
W80-00501

1B. Aqueous Solutions and Suspensions

BEST WAYS TO DEWATER DREDGED MATERIAL,
Oklahoma State Univ., Stillwater. Dept. of Geotechnical Engineering.
For primary bibliographic entry see Field 2G.
W80-00733

2. WATER CYCLE

2A. General

NOTE TO THE UNITED NATIONS WATER CONFERENCE ON PREPARATIONS FOR THE UNITED NATIONS CONFERENCE ON DESERTIFICATION.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 2, p 865-870.

Descriptors: *Arid lands, *Desertification, *Deserts, *International cooperation, *United Nations, Arid climates, Ecology, Ecosystems, Technology, Environmental effects, Climate, Reviews, Maps, Planning, Regional planning, Water management(Applied), Tunisia, Chile, Niger, India, Iraq, Pakistan, Australia, Iran, Israel, Oregon, Soviet Union, China.

The United Nations Conference on Desertification will deal with ecological situations in which: (1) water is scarce due to climate, and (2) the ecosystem is degraded because of human interference. Maps were produced of world deserts and desertification (1:25 million), and of aridity showing ratios between rainfall and potential evapotranspiration, as well as topography, soils, and vegetation. Other maps will show desertification in Africa north of the equator (1:5 million), possibly a similar one on South America, a climate aridity map of the world based on Budyko's radiational index of dryness, and maps of case study areas. Four global component reviews were prepared to assess present knowledge of desertification in relation to: (1) climate, (2) ecological change, (3) technology, and (4) population and society. An overview of the reviews will also be presented, which will provide scientific guidelines and justification for the Plan of Action to Combat Desertification. Case studies will be in two series: (1) six UNESCO studies of portions of Tunisia, Chile, India, Niger, Iraq, and Pakistan; and (2) nine studies prepared by the governments of Australia, China, Iran, Israel, United States, and Soviet Union. A Synthesis of the Case Studies will summarize conclusions. Feasibility studies for transnational projects will be conducted. The Plan of Action will provide guidelines and recommendations for measures at the national, regional, and international levels, addressing problems of both land and people. Water management will be a central issue. (Lynch-Wisconsin)
W80-00422

ENVIRONMENTAL ISSUES IN RIVER BASIN DEVELOPMENT,
United Nations Environment Program, Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, Part 3, p 1163-1172.

Descriptors: *Dams, *Environmental effects, *Ecosystems, *Water supply development, *River basin development, Aquatic weeds, Social impact, Public health, Human diseases, Schistosomiasis, Malaria, Trypanosomiasis, Onchocerciasis, Ecology, Wetlands, Eichhornia crassipes, Pistia stratiotes, Habitats.

Environmental effects of dam construction in river basins and methods of minimizing such effects are described. Large dams tend to have particularly significant and complex effects on aquatic ecosystem which must be carefully evaluated prior to construction. Rational development involves: (1) a comprehensive basinwide assesment of social, economic, and ecological characteristics and of the effects of development; (2) evaluation of development alternatives reflecting social, economic, and environmental factors to provide the basis for environmental management. Dam construction can provide the water supply, hydroelectric power, and flood control, and can greatly improve agriculture, forestry, and livestock management. Excessive use of water and agricultural chemicals can however, cause waterlogging and salinization, and can affect water quality and quantity. Dams produce a permanent physical transformation, inundating settled areas and destroying habitats, affecting the groundwater regime and water table, possibly increasing seismic tendencies, and often leading to explosive aquatic weed growth and the spread of schistosomiasis and other communicable diseases. Dams in tropical areas tend to favor weed propagation and vectors of parasitic diseases, while temperate-zone dams often interfere with fish migration. Resettlement of population displaced by dams often leads to housing, disease, and social problems. Loss of wetlands endangers many plant and animal species. (Lynch-Wisconsin)
W80-00433

WORLD WATER BALANCE AND WATER RESOURCES OF THE EARTH,
National Committee for the International Hydrological Programme (USSR).
V.I.I. Korzoun, and A. A. Sokolov.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2199-2215.

Descriptors: *World, *Water resources, *Water balance, *Oceans, *Precipitation(Atmospheric), *Hydrologic cycle, Freshwater, Rivers, River basins, Runoff, Evaporation, Glaciers, Water storage, Forecasting, Estimating, Discharge(Water), Reservoirs, Water utilization, Consumptive use, Lakes, Distribution.

An inventory of world water resources and a global water balance are extracted from a monograph of the same title published in 1974. Sections include: (1) world water storage, (2) the water cycle and the world water balance, (3) dynamic (resumed) fresh-water resources and their world distribution, and (4) use of natural water. Static water storage is 1386 million cu km, 96.5% (1338 million cu km) in the world ocean. The major portion of water on the continents is in the solid phase, accumulated in glaciers and snow cover of the Antarctic, the Arctic, and Greenland. The major link in the water cycle is water exchange between ocean and land; 505,000 cu km annually evaporates from the ocean surface with 458,000 cu km (90%) returning to the ocean as precipitation and 47,000 (10%) as land discharge. Of total precipitation onto the land, 61% is lost to evaporation and 39% is discharged into the world ocean or large endorheic lakes. Total water resources of the earth amount to 577,000 cu km. Mean annual basin runoff is usually used to evaluate freshwater resources. At present, to supply a city of one million people, at least 0.5 million cu m of water/day are needed, to rise to 1.0 million in the future. Total water consumption has increased from 400 cu km/yr (270 cu km lost) in 1900 to 2600 cu km (1600 lost)in 1970. Consumption is expected to increase to 6000 cu km by the year 2000, with 3000 cu km lost. (Lynch-Wisconsin)
W80-00466

THE MAIN DIRECTIONS OF HYDROGEOLOGICAL INVESTIGATIONS FOR THE SUBSTANTIATION OF ARTIFICIAL RECHARGE,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology.
K. I. Sychev, M. A. Khordikainen, and V. S. Usenko.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2231-2248.

Descriptors: *Soviet Union, *Artificial recharge, *Groundwater recharge, *Water supply development, *Methodology, Groundwater, Hydrogeology, Aquifers, Water storage, Heated water, Water pollution control, Salinity, Water purification, Mapping, Research priorities.

Artificial recharge of groundwater and storage of surface runoff in natural subsurface reservoirs are the most effective methods of preventing groundwater depletion and of insuring their availability to the water supply. Such measures are used in the Soviet Union for: (1) increasing operating water intake yields, (2) regulating water resources, (3) improving water quality, (4) cooling water heated in air-conditioning systems, (5) forming freshwater lenses among saline ones, and (6) protecting aquifers from saline water intrusions and effluent contamination. Increasing groundwater quantity has helped purify polluted surface water. Artificial recharge is usually more economical than other water supply methods, and is 20-30% cheaper than surface water purification. The Soviet Union emphasizes: bed regulation of surface runoff; improving permeability of bottom deposits; induced seepage; and to a limited extent construction of special systems such as recharge basins, canals, infiltration galleries, ponds, temporary basins, and clearing of river bottom deposits. A program of research and development was carried out in 1971-75. Regional investigations, including mapping, identified the most suitable areas for recharge projects, and a substantiating methodology was devised which assesses: (1) water quantity and quality; (2) hydrogeological, sanitary, and technological conditions; (3) method selection; (4) recharge structure operation; (5) effects of recharge on groundwater quality; (6) water intake efficiency; and (7) economic effectiveness. (Lynch-Wisconsin)
W80-00468

ISRAEL- A MODEL OF EFFICIENT UTILIZATION OF A COUNTRY'S WATER RESOURCES,
Ministry of Agriculture, Tel-Aviv (Israel).
For primary bibliographic entry see Field 6E.
W80-00471

SIMULATION ANALYSES: THE DETAILED MODEL,
Simon Bolivar Univ., Caracas (Venezuela).
J. Valdes, B. Harley, and J. C. Schaake Jr.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 95-107, 1979. 4 fig, 19 ref.

Descriptors: *Simulation analysis, *Model studies, *Parametric hydrology, *Streamflow, *Water resources development, *Projects, *Hydrologic cycle, *Rio Colorado(Argentina), Snowmelt, Channel routing, Overland flow, Infiltration, Evapotranspiration, Salt balance, Groundwater, Reservoirs, Irrigation areas, Screening model, Hydrologic data, Diversion, Equations, Systems analysis.

The Rio Colorado study has utilized a basic simulation model for evaluating the overall performance of alternative development configurations. This chapter describes the nature and use of the detailed simulation model, used for the important supporting tasks of parameter estimation, streamflow generation, and verification, and contrasts it with the basic simulation model. The basic model uses a nodal structure, incorporating a set of projects and running a time series of streamflow through the system year by year; this unified model with simple physical representations analyzes complete river basin alternatives in terms of benefits and costs (see Chapter Six of the Major

and Lenton book). The detailed simulation model, however, has three types of components or modules: (1) those representing the hydrologic cycle as it characterizes the Rio Colorado, including snowmelt runoff, channel routing, overland flow, infiltration and evapotranspiration, groundwater flow, and salt balance; (2) those representing the types of development projects in the Rio Colorado, such as dams, irrigation areas, hydroelectric plants, and diversions, imports, and exports; and (3) that for generating synthetic streamflow series. The detailed simulation model includes explicit representations of hydrologic processes. The entire set of streamflows is run through the module found furthest upstream, and this process is repeated progressively down to the downstream end. The analysis in each module can be performed in terms of very small time steps, the length of which can be varied according to the degree of detail required. (Bell-Graf--Cornell)
W80-00561

LANDSAT-DERIVED SNOW COVER AS A FORECAST TOOL IN THE RIO GRANDE BASIN IN COLORADO,
Soil Conservation Service, Denver, CO.
For primary bibliographic entry see Field 2C.
W80-00573

A STORAGE ROUTING MODEL BASED ON CATCHMENT GEOMORPHOLOGY,
Wollongong Univ. (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-00590

FOUNDATION THEORIES OF SOLUTE TRANSPORT IN POROUS MEDIA: A CRITICAL REVIEW,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
G. Sposito, V. K. Gupta, and R. N. Bhattacharya.
Advances in Water Resources, Vol. 2, No. 2, p 59-68, June 1979. 1 tab, 39 ref. NSF ENG 76-09210, ENG 76-09081.

Descriptors: *Reviews, *Mathematical models, *Dispersion, *Porous media, *Solutes, *Theoretical analysis, Equations, Markov processes, Stochastic processes, Fluid mechanics, Hydrodynamics, Thermodynamics, Statistics, Velocity, Diffusivity, *Transport equations.

The theories that have been employed to derive the macroscopic differential equations that describe solute transport through porous media were reviewed critically. Theories of class 1 (those based in fluid mechanics) have had to employ highly artificial models of a porous medium or to assume that well-defined solutions of the equations of fluid mechanics exist in the porous medium. Theories of class 2 (those based in kinematic approaches) suffer from the absence of a firm dynamical basis for the stochastic properties they attribute to the velocity of a solute molecule. Theories of class 3 (those based on a formal analogy between statistical thermodynamics and hydrodynamic dispersion) have had an unclear physical content. None of the existing foundational theories has yet achieved the objectives of: (1) deriving, in a physically meaningful and mathematically rigorous fashion, the macroscopic differential equations of solute transport theory, and (2) elucidating the structure of the empirical coefficients appearing in these equations. (Visocky-ISWS)
W80-00606

NOTE ON THE DISTRIBUTION OF FLOOD MAXIMA FOR RANDOM SAMPLE SIZE,
Otago Univ., Dunedin (new Zealand). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W80-00611

ON THE THEORETICAL BASIS OF MODELLING THE QUALITY OF SURFACE AND SUBSURFACE WATERS,
Deutsche Akademie der Wissenschaften zu Berlin (German D.R.). Inst. fuer Geographie and Geookologie.
For primary bibliographic entry see Field 5B.
W80-00700

A DYNAMIC MODEL OF THE CHEMICAL NUTRIENT SYSTEM FOR RESEARCH OF THE ECOLOGICAL CONSEQUENCES IN NATURAL WATER,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 5B.
W80-00701

AN EFFORT FOR MODELLING THE TRANSPORT OF MICROPOLLUTANTS IN RIVERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 5B.
W80-00702

HYDROLOGICAL AND GEOCHEMICAL MASS BALANCE IN SMALL FORESTED AND AGRICULTURAL BASINS,
Corporation for Engineering, Geological and Hydrological Investigation, Prague (Czechoslovakia). Stavebni Geologie.
J. Balek, B. Moldan, T. Paces, and J. Skorepa.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 50-58, 1978. 6 fig, 2 tab, 3 ref.

Descriptors: *Watersheds(Basins), *Runoff, *Water quality, *Hydrology, Mathematical models, Water balance, On-site investigations, Seasonal, Discharge(Water), Hydrographs, Demonstration watersheds, Forest watersheds, Agricultural watersheds, Foreign research, Water properties, Sodium, Calcium, Aluminum, Suspended load, Silica, Sulfur, Nitrogen, Phosphorous, Conductivity, *Czechoslovakia, Mass balance.

The mass balance of Na, Ca, Al, Si, Cl, S, N, and P in two drainage basins (0.984 and 0.586 sq km) indicates profound differences in the fluxes of the elements into and out of agricultural and forested areas. The seasonal variations in dissolved sodium and electrical conductivity correlate positively with the discharge when the surface runoff is negligible. The correlation is negative when the surface runoff is an important part of the total runoff. The concentration of sodium is in a steady state in spite of the fact that the flux of sodium from the basins exhibits seasonal variations. The surfaces of feldspars exposed to solution by interflow and groundwater flow may be the cause of this phenomenon. A simple model was presented for the three-part separation of the hydrograph using the measurements of electrical conductivity during a rapid rainfall. (See also W79-00379) (Humphreys-ISWS)
W80-00703

EFFECTS OF THE CONSTRUCTION OF A BROAD WATERWAY ON THE WATER QUALITY OF THE DOUBS (EFFETS DE LA CANALISATION A GRAND GABARIT SUR LA QUALITE DES EAUX DU DOUBS),
Electricite de France, Chatou. Direction des Etudes et Recherches.
For primary bibliographic entry see Field 5B.
W80-00704

MASS TRANSFER MODELS OF SORPTION AND DESORPTION OF RADIONUCLIDES BY AQUATIC PLANTS,
Institute of Meteorology and Water Management, Warsaw (Poland).
M. J. Gromiec, and S. Matsui.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 68-76, 1978. 1 fig, 1 tab, 7 ref.

Descriptors: *Mass transfer, *Model studies, *Aquatic environment, *Water quality, Sorption, Radioisotopes, Aquatic plants, Mathematical models, Algae, Chlorella, Mercury, Chlorides, Kinetics, Equations, Aquatic production, Radionuclide transport, Desorption.

The basic mathematical models describing the transport of radionuclides in an aquatic environment and containing the uptake and release terms were presented. The development of three mass transfer models employing a uniform function, an exponential function, and a power function to describe the kinetics of sorption and desorption was given. The application of the mass transfer models to the sorption and desorption kinetics of mercurials by the algal biomass was presented as an example. The sorption and desorption of mercuric chloride and methylmercuric chloride by Chlorella pyrenoidosa were described respectively by the uniform function model and the exponential function model. The influence of environmental factors on the biological accumulation of mercurials in algae was also discussed. The application of these transfer models indicates the possible involvement of two distinct mechanisms. These models of the sorption and desorption may be applied to forecast levels of concentration and the extent of desorption from algae, as well as determining the rate of these processes in relation to specific ecological conditions. (See also W79-00379) (Humphreys-ISWS)
W80-00705

USE OF WATER QUALITY VARIABLES FOR ESTIMATION OF WATER QUANTITY CHARACTERISTICS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. Yevjevich, and T. G. Sanders.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 106-112, 1978. 3 fig, 12 ref.

Descriptors: *Water quality, *Hydrograph analysis, *Model studies, *Runoff forecasting, Demonstration watersheds, Rainfall-runoff relationships, Water properties, Tracers, Analytical techniques, Mathematical models, On-site tests, Flow, Discharge(Water), Runoff, Overland flow, Travel time, Water pollution, Herbicides, Volume.

This paper treated the two basic problems in which water quality properties are used for estimating the basic characteristics of water quantity hydrographs, namely: (1) the estimation of parameters for a kinematic wave model of overland flow by measuring the transport characteristics of chemical water quality variables; and (2) the estimation of the origin of water in a hydrograph resulting from partial rainfall coverage over a river basin by using various chemical tracers. These studies then indirectly represent the response of water quality variables in the form of responses of selected chemicals over the river basin to rainfall input. The results of studies presented may be considered as paralleling the study of migration of non-point sources of chemical, biological, or physical (debris) pollutants in river basin runoff hydrographs. Preliminary research on an impervious basin, the 24,000 sq ft rainfall-runoff facility at Colorado State University, has given indications that the peak concentration as well as the water quality hydrograph may also be estimated given the discharge hydrograph ofa small basin, and the areal distribution of the known amount of the tracer applied to the basin. (See also W79-00379) (Humphreys-ISWS)
W80-00709

STREAMFLOW GENERATION IN A FORESTED WATERSHED, NEW ZEALAND,
Forest Research Inst. Christchurch (New Zealand).
For primary bibliographic entry see Field 2E.
W80-00724

A STATISTICAL METHOD FOR MODELLING THE FATE OF RAINFALL IN A TROPICAL RAINFOREST CATCHMENT,

James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W80-00748

GROUND-WATER APPRAISAL FOR THE COMMUNITY OF KIRYAS JOEL, ORANGE COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
R. M. Waller.
Geological Survey open-file report 79-401, 1979. 23 p, 9 fig, 3 tab, 7 ref.

Descriptors: *Groundwater resources, *Groundwater availability, *Water quality, *Aquifer testing, *Groundwater potential, Water supply, Test wells, Pumping, Water yield, Aquifer characteristics, Fracture permeability, Surface-groundwater relationships, Evaluation, New York, *Orange County(NY), *Kiryas Joel(NY).

A major fracture system in indurated sedimentary rocks forms a moderately extensive aquifer yielding 100-300 gallons per minute to wells 160 to 420 feet deep. Pumping-test data show that the fracture system is interconnected to distances more than 1,000 feet from the wells. Recharge occurs through overlying clayey till, and continuous pumping may induce recharge from surface-water sources. Chemical analyses indicate no water-quality problems. Systematic collection of data on pumpage, water level, and chemical quality could help to determine the long-term adequacy of the aquifer system. (Woodard-USGS)
W80-00759

2B. Precipitation

INCREASING AVAILABLE WATER SUPPLIES THROUGH WEATHER MODIFICATION AND DESALINATION,
Bureau of Reclamation, Washington, DC.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2489-2501.

Descriptors: *Weather modification, *Desalination, *Water supply development, *Arid lands, *Pacific Coast Region, *Rocky Mountain Region, California, Colorado River Basin, Rio Grande Basin, Water sources, Water resources development, Water management(Applied), Cloud seeding, Cloud physics, Bureau of Reclamation, Geothermal studies, Project Skywater, Distillation, Reverse osmosis, Electrodialysis, Ion exchange, Membrane processes.

The current phase of the Federal Reclamation Act of 1902 and amendments mandates weather modification and desalination projects in the western U.S. Preliminary results of Project Skywater, the multiphase research program in cloud seeding (weather modification) indicates that seeding specific types of clouds either increases or decreases precipitation. Increases now generally range 8-15%, but may approach 30% with refined technology. Current research projects: (1) a cumulus cloud experiment at three sites on the western Great Plains, concerned with seeding summer convective clouds; and (2) winter cloud seeding technology in maritime air masses for enhanced snowfall (Sierra Nevada, California). Seeding with silver iodide is accomplished either from aircraft or from the ground using pyrotechnics. Four desalination processes are comercially available: (1) distillation, (2) reverse osmosis, (3) electrodialysis, and (4) ion exchange. Freezing processes are under development. Distillation is generally used for seawater, electrodialysis and reverse osmosis (membrane processes) for brackish water, and ion exchange as pretreatment for softening water or post-treatment for improving other desalting procedures. Bureau of Reclamation projects: (1) salinity control on the Colorado River, (2) desalting hot geothermal brines in southeast California, and (3) seawater desalting in California's Santa Barbara Channel. (Lynch-Wisconsin)
W80-00479

A WIND TUNNEL INVESTIGATION OF THE RATE OF EVAPORATION OF LARGE WATER DROPS FALLING AT TERMINAL VELOCITY IN AIR,
California Univ., Los Angeles. Dept. of Atmospheric Sciences.
H. R. Pruppacher, and R. Rasmussen.
Journal of the Atmospheric Sciences, Vol. 36, No. 7, p 1255-1260, July 1979. 2 fig, 21 ref. NSF ATM78-10817.

Descriptors: *Raindrops, *Evaporation, *Ventilation, *Laboratory tests, Precipitation(Atmospheric), Rainfall, Drops(Fluids), Particle size, Reynolds number, Cloud physics, Laboratory equipment, Instrumentation, Meteorology, Wind tunnels

An experimental study of the effect of ventilation on the rate of evaporation of millimeter sized water drops falling at terminal velocity in air has been carried out in a wind tunnel where drops were suspended freely in the tunnel air stream. It was found that for drops in the size range 1.15 and 2.50 mm in radius, the mean ventilation coefficient could be expressed as $f = (0.78 + \text{or} - 0.02) + (0.308 + \text{or} - 0.010)X$, where $X = N$ sub Sc,v to the 1/3 power times N sub Re to the 1/2 power. Previously, it was shown that this relation holds for drops in the size range between 0.06 and 0.40 mm in radius. Taken together, present and previous data suggest that with reasonable accuracy $f = 0.78 + 0.308$ X, for X between 1.4 and 51.4 (between 0.06 and 2.50 mm in radius). For X between 0 and 1.4 (radius between 0 and 0.06 mm), one may use the previous result $f = 1.00 + 0.108$ X sq. To illustrate how the present data may be applied, the distance which is required for a water drop to travel from cloud base through a NACA Standard Atmosphere of various relative humidities in order to reach the earth's surface with a given size was computed. (Sims-ISWS)
W80-00602

DETAILED STRUCTURE OF PH IN HYDROMETEORS,
Maryland Univ., College Park.
For primary bibliographic entry see Field 2K.
W80-00616

WEAK AND STRONG ACIDS IN THE SURFACE WATERS OF THE TOVDAL REGION IN S. NORWAY,
Central Electricity Generating Board, Leatherhead (England). Research Lab.
For primary bibliographic entry see Field 2K.
W80-00624

PRECIPITABLE WATER OVER THE UNITED STATES. VOLUME II: SEMIMONTHLY MAXIMA,
National Weather Service, Silver Spring, MD. Office of Hydrology.
F. P. Ho, and J. T. Riedel.
NOAA Technical Report NWS 20, July 1979. 363 p, 22 fig, 3 tab, 15 ref.

Descriptors: *Precipitable water, *Water vapor, Moisture content, United States, Alaska, Semimonthly maxima.

Observed semimonthly maxima and means of the series of semimonthly maxima precipitable water are presented in tabular, graphical, and map form for all radiosonde stations in the contiguous United States for the period 1946-72 and for Alaska for the period 1950-69. These data are given by layers from the surface to 400 mb from twice-daily observations. (NOAA)
W80-00698

EXTENSION OF RIVER FLOW RECORDS IN ARGENTINA FROM LONG TREE-RING CHRONOLOGIES,
Arizona Univ., Tucson. Lab. of Tree-Ring Research.
For primary bibliographic entry see Field 2E.
W80-00731

SECULAR TREND IN EXTREME RAINFALLS,
Scientific and Education Administration, Beltsville, MD. Hydrology Lab.
D. M. Hershfield.
Journal of Applied Meteorology, Vol. 18, No. 8, p 1078-1081, August 1979. 2 fig, 4 ref.

Descriptors: *Rainfall, *Precipitation excess, *Statistics, Precipitation(Atmospheric), Data processing, Analytical techniques, Statistical methods, Frequency, Meteorology, Extreme rainfalls, Secular trends, Return periods.

Increasing attention has recently been given to many facets of climate change. This study focused on a possible trend in extreme rainfalls in the past two decades based on the records of 135 National Weather Service stations in the eastern United States. The standard used to compare the recent data was Weather Bureau Technical Paper No. 40. The two frequencies examined were the 2- and 100-year 24 h return periods. No trend was discernible. (Sims-ISWS)
W80-00735

SILVER CONCENTRATION IN RAINWATER FROM SEEDED AND NONSEEDED FLORIDA CUMULI: 1973-1975 RESULTS,
MITRE Corp., McLean, VA.
J. Wisniewski, and R. I. Sax.
Journal of Applied Meteorology, Vol. 18, No. 8, p 1044-1055, August 1979. 5 fig, 7 tab, 33 ref. NSF AEN75-19817, DES74-18536.

Descriptors: *Cloud seeding, *Rainfall, *Silver iodide, *Florida, Sampling, Chemical analysis, Weather modification, Rain water, Air circulation, Winds, Data collections, Aircraft, Analytical techniques, Weather, Meteorology, *Silver concentration.

The main objective of the Florida Area Cumulus Experiments was to seed groups of supercooled tropical cumulus clouds to convert enough water to ice so that sufficient heat could be released to enhance cloud growth and augment rainfall over a specific south Florida target area. During three consecutive summers (1973-75), subprograms to monitor the rainwater silver concentrations were conducted. Results showed that rainwater silver concentrations can be detected in significantly higher concentrations in seeded vs nonseeded samples with a carefully positioned network and with precise care in the preparation, collection, handling, storage, and analysis of the samples. In addition, the silver concentrations in the seeded rainwater samples were low enough to present no ecological or environmental problems whatsoever under the present seeding rates in south Florida. Stratification of the rainwater silver concentrations, using two different trajectory techniques, showed silver concentrations collected under continental influenced regimes to be almost identical to those collected under seeding conditions. This is a crucial result since, if rainwater silver concentrations are being used to determine whether the seeding material is being targeted in the optimum areas for maximum seeding efficiency, then the results may be biased under these continental influenced regimes. (Sims-ISWS)
W80-00736

RAINFALL INTERCEPTION BY EIGHT SMALL TREES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
For primary bibliographic entry see Field 2I.
W80-00744

2C. Snow, Ice, and Frost

GLACIOLOGICAL DATA: WORKSHOP ON SNOW COVER AND SEA ICE DATA.
Colorado University, Boulder, Institute of Arctic and Alpine Research. Report GD-5, May 1979. 127 p, 28 fig, 10 tab, 162 ref, 1 append.

Descriptors: *Conferences, *Snow, *Ice, *Sea ice, *Glaciology, *Arctic, Data collections, Climatolo-

gy, Meteorology, Hydrology, Oceanography, Water resources, Satellites(Artificial), Mapping, River basins, Monitoring.

Under a NOAA/EDIS contract, the Data Center is preparing an inventory of snow cover and sea ice data. The primary focus to date has been on map series and other data products describing cryospheric parameters on a regional to global scale. As part of this endeavor, the WDC arranged a two-day workshop of agency representatives and interested scientists in Boulder, 2-3 November 1978, on The Mapping and Archiving of Data on Snow Cover and Sea Ice Limits. While the attendees, with one exception, were from North America, the workshop recommendations and the material presented here are of broad relevance to problems of worldwide concern in the environmental sciences, especially climatology, meteorology, hydrology, and oceanography. This issue contained the workshop recommendations and papers (or summaries). (See W80-00567 thru W80-00578) (Froehlich-ISWS)
W80-00566

SNOW AND ICE DATA SETS FOR CLIMATE AND WATER RESOURCE STUDIES WITH PARTICULAR REFERENCE TO NORTH AMERICA,
National Center for Atmospheric Research, Boulder, CO.
R. L. Jenne, R. G. Crane, and P. K. MacKinnon.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 7-23, May 1979. 3 fig, 1 tab, 62 ref, 1 append.

Descriptors: *Snow, *Ice, *Glaciology, *Documentation, *North America, Bibliographies, Water resources, Data collections, Information retrieval, Publications, Weather data, Sea ice, Maps, Hydrologic aspects, *USSR, Data sources.

The paper focused on sources of snow and ice data sets, snow and ice gridded data products, and related hydrometeorological data. Major data sets on snow cover and sea ice, including the results of both historical and current surveys, are held at the World Data Center A for Glaciology (Snow and Ice), which is colocated with the National Geophysical and Solar Terrestrial Data Center in Boulder, Colorado. Archives of climatological data exist in national and international repositories. In the United States, the NOAA Environmental Data and Information Service operates the National Climatic Center (NCC). This is the central U.S. repository for atmospheric data. At the operational level, the National Weather Service is responsible for collecting and assessing real-time data. At the international level, the World Meteorological Organization (WMO), a United Nations agency, in collaboration with the International Council of Scientific Unions, supports world data centers for climatological data. In conjunction with the WMO-established Global Telecommunications System (GTS), meteorological data are channeled to the World Data Centers for Meteorology: A in Asheville, North Carolina; B in Moscow, USSR; and C in Melbourne, Australia. Each data center archives various global data sets. In the United States, NCC also maintains an extensive inventory on GTS-sampled data. (See also W80-00566) (Humphreys-ISWS)
W80-00567

DATA SOURCES AND SEA ICE PRODUCTS OF FLEET WEATHER FACILITY/JOINT ICE CENTER, SUITLAND,
Fleet Weather Facility, Suitland, MD.
R. H. Godin.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 29-35, May 1979. 3 fig, 8 ref.

Descriptors: *Sea ice, *Data collections, *Maps, *Forecasting, Analysis, Surveys, Analytical techniques, Climatology, Cold regions, Arctic, Data sources.

This paper was developed to systematically describe and explain data sources, method of production, and products of the weekly sea ice analysis program. Manually analyzed Eastern and Western Arctic Sea Ice Charts are produced weekly as a synthesis of ice data and satellite information of varying resolution and utility. Seven-day ice limit forecasts reflect anticipated trends. The forecast is intended to depict anticipated trends in ice limit positions. Available guidance is in the form of automated 144-hour wind/current ice vector forecasts at 207 Arctic grid point locations and the application of persistence, extrapolative, and climatological ice movement rates. Diagnostic aids involving positive and negative degree-day accumulations and station temperature summaries are also considered. Compilations of weekly ice analyses are bound into a book format and are available from the National Technical Information Service in microfiche or hard copy form. (See also W80-00566) (Humphreys-ISWS)
W80-00568

MAPPING AND ARCHIVING OF CANADIAN SEA ICE DATA,
Atmospheric Environment Service, Downsview (Ontario).
For primary bibliographic entry see Field 7C.
W80-00569

A DMSP NEAR IR SENSOR FOR CLOUD/SNOW DISCRIMINATION,
Westinghouse Electric Corp., Baltimore, MD.
For primary bibliographic entry see Field 7B.
W80-00570

THE UNITED STATES ENVIRONMENTAL SATELLITE DATA ARCHIVES,
National Climatic Center, Asheville, NC.
For primary bibliographic entry see Field 7B.
W80-00571

SATELLITE-DERIVED RIVER BASIN SNOW-COVER PERCENTAGES: A NEW DATA BASE FOR HYDROLOGISTS,
National Environmental Satellite Service. Washington, DC.
For primary bibliographic entry see Field 7B.
W80-00572

LANDSAT-DERIVED SNOW COVER AS A FORECAST TOOL IN THE RIO GRANDE BASIN IN COLORADO,
Soil Conservation Service, Denver, CO.
B. A. Shafer.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 61-69, May 1979. 6 fig, 5 ref.

Descriptors: *Snow cover, *Watersheds(Basins), *Colorado, *Rio Grande River, Remote sensing, Snow surveys, Satellites(Artificial), Forecasting, Snowmelt, On-site investigations, Areal, Flood forecasting, Streamflow forecasting, Methodology, Snow, Mapping, LANDSAT.

The study approach involved a four-step analysis: (1) to identify specific drainage basins and acquire the Landsat imagery to cover them; (2) to examine various techniques of mapping the snow cover and determine which method is most useful in an operational mode; (3) to develop a methodology for including snow-covered area in a forecast of snowmelt runoff; and, (4) to evaluate the adequacy of the forecasting techniques which employed snow cover. Use of snow areal extent measurements in snowmelt runoff prediction in the Rio Grande shows promise, but with the short period which the study encompassed, it is difficult to assess its long-range impact. Currently (1978) available Landsat imagery is of sufficient quality and resolution for accurate snow mapping by photo interpretative means. Delay in image delivery, occurrence of cloud cover, and a 9-day interval between satellite coverage diminish to a significant extent the amount of reliance one can place in using snow cover as a forecast parameter. Three methods of using snow cover area in forecasting have been explored and have proven successful. A statistical regression model relates snow cover to season volume flow directly. An empirical method relates seasonal snowpack depletion to seasonal and annual yields. A computerized simulation model provides short-term and seasonal forecasts using snow cover as an input variable. (See also W80-00566) (Humphreys-ISWS)
W80-00573

ARCHIVING AND MAPPING OF CANADIAN SNOW COVER DATA,
Atmospheric Environment Service, Downsview (Ontario).
B. F. Findlay, and B. E. Goodison.
In: Glaciological Data; Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 71-87, May 1979. 7 fig, 2 tab, 20 ref.

Descriptors: *Snow cover, *Canada, *Mapping, *Data storage and retrieval, Maps, Hydrologic aspects, Areal, Data processing, Data collections, Snowfall, Surveys, Snow surveys, Ice, Water equivalent, Publications, On-site data collections, Remote sensing, Measurement.

The snow resource is documented for quantity, distribution, and timing by networks of meteorological observing stations and snow courses operated by public and private agencies. Archiving makes widespread use of computer compatible methods, but some smaller agencies continue to rely on hand tabulation. This paper presented an overview of these procedures and practices but concentrated on the activities of the Atmospheric Environment Service as a lead agency in the collecting, processing, publishing, and preserving of national snow cover information. (See also W80-00566) (Humphreys-ISWS)
W80-00574

ACCURACY OF SNOW AND ICE MONITORING,
Lamont-Doherty Geological Observatory, Palisades, NY.
G. Kukla, and D. Robinson.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 91-97, May 1979. 2 fig, 3 tab, 8 ref. NSF ATM77-28522.

Descriptors: *Snow cover, *Monitoring, *Ice cover, *United States, Analytical techniques, Analysis, Data collections, Maps, Mapping, Distribution, Areal.

In order to examine the accuracy of the operational snow charts, the authors produced a new, independent, updated set of snow maps for three selected blocks in the United States. Satellite information for each day was recharted and completed by incorporating reports from the ground stations. Given the frequently irregular and sketchy character of the snow fields, the difficulties in distinguishing snow in heavily forested areas, and the rapid changes of snow cover in the selected intervals, the accuracy of the charts was considered to be sufficiently high for climate-related studies on a continental or hemispheric scale. The Navy and NESS operational charts of sea ice covers were checked using a method similar to that used in the snow map analyses. Results will be reported in more detail elsewhere. In general, the quality of both sets was found to be sufficiently high for use in climate-related studies. Suggestions for future snow and ice map products: (1) A minimum scale of 1:30,000 is needed. (2) Reflectivity classes should be more detailed, at least 6 classes. (Brightness data are preferable to snow depth for the purposes of climate dynamic studies.) (3) Charts should distinguish between data recorded on the day that the chart is dated and data collected on previous days. (4) The proportion of snow to bare ground should be given where possible. (5) Where possible, areas of melting snow cover on the pack ice should be indicated. (6) Where possible, relative reflectivity of sea ice should be indicated in Navy charts. (See also W80-00566) (Humphreys-ISWS
W80-00575

AN ARCTIC SEA ICE DATA SET, 1901-1956,
University of East Anglia, Norwich (England). Climate Research Unit.
P. M. Kelly.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 101-106, May 1979. 1 fig, 1 tab, 25 ref, 1 append. ONR N00014-77-G-0074.

Descriptors: *Sea ice, *Data processing, *Data collections, *Arctic, Data storage and retrieval, Analytical techniques, Analysis, Distribution, Areal.

The Climatic Research Unit, University of East Anglia, is engaged in a feasibility study of the potential for Arctic sea ice prediction on climatic time scales. The main stages in this research were summarized in an appendix. The program includes the collection of sea ice data for the Arctic covering the 20th century; the statistical analysis of these data to identify the major fluctuations in sea ice extent, both spatially and temporally; correlation with climatic and atmospheric circulation data to determine the immediate causes of these sea ice variations, not excluding the possibility of feedback; and research, both theoretical and empirical, aimed at achieving the degree of understanding of the causes of these variations in climate and sea ice which is a necessary prerequisite to any predictive effort. This paper dealt with the first stage in this research: the collection of Arctic sea ice data for the 20th century. (See also W80-00566) (Humphreys-ISWS)
W80-00576

INADEQUACIES IN ARCHIVED SEA ICE DATA,
Sea Ice Consultants, Camp Springs, MD.
W. S. Dehn.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 107-108, May 1979.

Descriptors: *Sea ice, *Data collections, *Data processing, *Arctic, On-site data collections, Ice, Distribution, Areal, Inadequate data.

This paper primarily emphasized correctable inadequacies existent in today's (1978) processing and use of sea ice data. The examples presented were examples of mistakes in plotting data, ineptness in the interpretation of satellite imagery, failure to incorporate other data, and a failure to maintain continuity and a constant watch on changing conditions. In the cases presented, an understanding of sea ice distribution and the meteorological/oceanographic influences, combined with a constant watch, the use of all possible data sources, and the exercise of quality control could have prevented the inadequacies. The three examples presented were: (1) One of the most dramatic short-term changes in the extent of sea ice occurred in the Bering Sea during the period from 4 March to 8 March 1970. During that period, the Bering Sea ice pack expanded some 330 km southward over a 72-hour period. This expansion was a result of freezing (formation of new ice) and ice drift. (2) During April and May of 1970, nearly 550 km of existing ice east of Greenland was not documented. The failure to record this was a matter of lack of understanding of sea ice distribution, ineptness in interpreting satellite imagery, a failure to maintain a watch on the ice edge, and a failure to incorporate foreign data. (3) Data from aerial ice reconnaissance conducted during early October 1959 were plotted in error and accepted by ice forecasters. The author concluded that personnel involved in compiling historical sea ice data should understand sea ice distribution and the influencing meteorological/oceanographic parameters, use all possible data sources, and exercise quality control. (See also W80-00566) (Humphreys-ISWS)
W80-00577

NASA MAPPING PROJECTS (SUMMARY),
National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, MD.
For primary bibliographic entry see Field 7C.
W80-00578

SEA ICE RIDGING OVER THE ALASKAN CONTINENTAL SHELF,
Army Terrestrial Sciences Center, Hanover, NH.
W. B. Tucker, III, W. F. Weeks, and M. Frank.
Journal of Geophysical Research, Vol. 84, No. C8, p 4885-4897, August 20, 1979. 13 fig, 1 tab, 24 ref.

Descriptors: *Sea ice, *Continental shelf, *Alaska, Remote sensing, Data collections, Aircraft, Data processing, Model studies, Mathematical models, Ice, Oceans, Arctic, Analytical techniques, Sea ice ridging, Ridge heights, Laser profilometer data.

Sea ice ridging statistics obtained from a series of laser surface roughness profiles were examined. Each set of profiles consisted of six 200-km long flight tracks oriented approximately perpendicular to the coastline of the Chukchi and Beaufort seas. The landward ends of the profiles were located at Point Lay, Wainwright, Barrow, Lonely, Cross Island, and Barter Island. The flights were made in February, April, August, and December 1976, and one additional profile was obtained north of Cross Island during March 1978. It was found that although there is a systematic variation in mean ridge height with season, with the highest values occurring in late winter, there is no systematic spatial variation in ridge height at a given time. The number of ridges/km (mu) also are high during the late winter, with the highest values occurring in the Barter Island and Cross Island profiles. In most profiles, the ice 20-60 km from the coast is more highly deformed (higher mu values) than the ice either nearer the coast or farther seaward. The Wadhams model for the distribution of ridge heights gives better agreement with observed values in the higher ridge categories than does the Hibler model. Estimates of the spatial recurrence frequency of large pressure ridges were made by using the Wadhams model and also by using an extreme value approach. In the latter, the distribution of the largest ridges per 20 km of laser track was found to be essentially normal. Wadhams' distribution consistently predicts slightly larger ridge sails than does the extreme value approach. The main factors currently limiting the accurate prediction of the temporal recurrence of large pressure ridges are limited knowledge of the drift of near-shore ice and data that would permit the assessment of year to year variability in mu. (Sims-ISWS)
W80-00738

ULTRASONIC VELOCITY INVESTIGATIONS OF CRYSTAL ANISOTROPY IN DEEP ICE CORES FROM ANTARCTICA,
Army Terrestrial Sciences Center, Hanover, NH.
H. Kohnen, and A. J. Gow.
Journal of Geophysical Research, Vol. 84, No. C8, p 4865-4874, August 20, 1979. 12 fig, 1 tab, 22 ref. NSF DPP76-18401.

Descriptors: *Ice, *Crystals, *Antarctic, Laboratory tests, Analytical techniques, Ultrasonics, Density, Anisotropy, Velocity, Glaciers, Cores, Glaciology, Rheology, Crystal anisotropy, Ice sheets.

Ice cores from Byrd Station and Little America V were used to test an ultrasonic technique for evaluating crystal anisotropy in the Antarctic Ice Sheet. P wave velocities measured parallel and perpendicular to the vertical axes of cores from the 2164-m-thick ice sheet at Byrd Station yielded results in excellent agreement with the observed c axis fabric profile and with the in situ P wave velocity profile measured parallel to the borehole axis. Velocity differences of Delta V in excess of 140 m/s for core samples from deeper than 1300 m attest to the strong single-pole clustering of crystallographic c axes about the vertical, especially in the zone from 1300 to 1800 m. Such oriented structure is compatible only with strong horizontal shearing in this zone. The existence in an ice sheet of widespread shearing, several hundred meters above its bed raises serious questions as to the validity of current concepts of the flow of large ice masses that tend to gloss over or ignore crystal alignments of this magnitude. In ice cores from the bottom 350 m at Byrd Station, the crystals are so large (up to 30 sq cm in cross-sectional area) that samples used for ultrasonic measurements usually contained too few crystals to yield fully reliable Delta V data. It was determined that a sample should contain at least 50 crystals if velocity bias resulting from group clustering of c axes in coarse-grained ice is to be avoided. (Sims-ISWS)
W80-00739

2D. Evaporation and Transpiration

HEAT AND MASS EXCHANGE COEFFICIENTS FOR OPEN WATER SURFACES,
Institute of Meteorology and Water Management, Warsaw (Poland).
D. Jurak.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 161-169, 1978. 2 tab, 7 ref.

Descriptors: *Heat balance, *Mathematical models, *Reservoirs, *Evaporation, Boundary processes, Surface waters, Air-water interfaces, Model studies, Heat budget, Water temperature, Analytical techniques, Theoretical analysis, Equations, Cooling, Heating, Thermal models.

By applying the square approximation of the total heat losses from the water temperature, new formulas were worked out for the evaluation of the heat exchange coefficients between the water surface and the atmosphere, heat losses and evaporation from the water surface of natural reservoirs, and those influenced by thermal discharges. Methods presented for the evaluation of the heat budget components and heat exchange between the water surface and the atmosphere were based on data from standard meteorological networks, and they can be applied in thermal models in order to predict water temperature and evaporation from existing and planned reservoirs. The proposed method is applicable for monthly as well as daily intervals, and the differences in determining heat losses and evaporation do not exceed + or -15 %. (See also W79-00379) (Humphreys-ISWS)
W80-00714

PREDICTING HYSTERETIC EFFECTS IN EVAPORATION FROM BARE SOIL,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
W. J. Staple.
Soil Science Society of America Journal, Vol. 43, No. 4, p 769-772, July-August 1979. 4 fig, 10 ref.

Descriptors: *Evaporation, *Soils, *Rainfall, Model studies, Drying, Simulated rainfall, Hysteresis, Wetting, Infiltration, Forecasting, Water conservation, *Wetting potential, *Dry soil, Soil water pressure, Redistribution, Drying potential, Scanning curves, Hysteretic effect.

Evaporation losses from initially dry soil moistened by simulated rainfall were computed on the assumption that the soil water pressure on drying was uniquely predicted by either the wetting or drying boundary curve of the hysteresis function. That is, hysteretic effects involving detailed drying scanning curves were neglected. The results showed that computed evaporation losses based on the two unique curves were nearly equal, and that these losses were only about 1/2 of those established previously both by evaporation measurement and by computations based on the appropriate scanning curves. It was concluded that hysteretic effects could not be neglected or estimated by a simple averaging procedure in predicting water conservation in summerfallow under semiarid conditions. (Roberts-ISWS)
W80-00732

2E. Streamflow and Runoff

HYDROLOGICAL FORECASTING FOR OPERATIONAL PLANNING AND MANAGEMENT OF WATER RESOURCES,
E. G. Popov.

In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2219-2228.

Descriptors: *Forecasting, *Planning, *Water management, *River flow, *Snowmelt, *Multiple-purpose reservoirs, Methodology, Hydrology, Water resources, Mountain rivers, Rivers, Meteorology, Precipitation(Atmospheric), Snow cover, Flood forecasting, Soviet Union, Reservoirs, Hydroelectric power, Navigation, Seasonal, Streamflow, Groundwater, Frequency.

Hydrological forecasting is necessary for optimal use of water resources, especially in relation to multipurpose streamflow storage reservoirs. Long-term forecasts (up to 12 mo in advance) are needed for optimal planning of: (1) electric power generation, (2) cropland management, (3) water distribution for irrigation, and (4) streamflow regulation for agriculture, fisheries, water supply, and inland navigation. In the Soviet Union 60-70% of seasonal runoff in many rivers depends on snowmelt, 90% in mountainous regions with dry summers. In peak years snowmelt flood flow can be 10 times greater than in the minimum year. Forecasts of river discharges and stages for the low-flow period when groundwater is the main source of river feed are also of great importance for operation of hydroelectric plants and reservoirs, navigation, and water supply projects. Such forecasts are issued 1-3 mo in advance. Long-range forecasts of snowmelt flood flow of lowland rivers are based on empirical relationships between seasonal snowmelt runoff and: (1) the water equivalent of snow cover before melting, (2) precipitation after melting begins, and (3) soil moisture factors. Such forecasts are within 20% of actual flow in 75-95% of cases. Forecasts of seasonal snowmelt flow for mountain rivers is based on snow storage in the mountains; 70-80% of forecasts are within 20% of real values. Low-flow forecasts, based on laws of water storage depletion in river basins, are more reliable where precipitation is relatively less important in flow formation. (Lynch-Wisconsin)
W80-00467

DISPERSION AND IMPACT OF MOBILE RIVER SYSTEM WATERS IN MOBILE BAY, ALABAMA,
Alabama Univ., Dauphin Island. Dauphin Island Sea Lab.
W. W. Schroeder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-102981, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Auburn University, Bulltin 37, August, 1979, 48 p, 20 fig, 3 tab. OWRT A-058-ALA(2), 14-34-0001-8001.

Descriptors: *Discharge rates, Salinity, Wind, Tide, Dispersion, Mixing, Mobile River, Mobile Bay.

Twenty-two field surveys, carried out between November, 1976, and September, 1978, are used to characterize the dispersion and impact of Mobile River System waters in Mobile Bay, Alabama. River discharge rates ranged from 7-day average low flows of < 400 cubic m sec-1, to a 5-year frequency flood of approx. 9,200 cubic m sec-1. These discharges serve as a simple source of fresh water at one extreme to a dominant role at the other extreme, rendering the majority of the bay a near lemnetic system. Salinity patterns that are longitudinally, laterally and vertically variable result from the mixing of river waters with bay waters. The configuration of the bay, local winds and astronomical tides are shown to play key modifying roles.
W80-00491

FLOOD HAZARD ANALYSES, LITTLE OSSIPEE RIVER, TOWNS OF ACTON, NEWFIELD AND SHAPLEIGH, MAINE, YORK COUNTY.
Soil Conservation Service, Orono, ME.
September 1977. 6 p, 8 fig, 8 plates, 1 tab.

Descriptors: *Maine, *Floods, *Historic floods, *Flood data, *Flood stages, *Peak discharge, *Stage-discharge relations, *Acton(ME), *Newfield(ME), *Shapleigh(ME), *Little Ossipee River(ME), Regional flood, Indirect flood measurement, Flood profiles, Rivers, Flood plains, Flood protection, Flood plain insurance, 100-year flood, 500-year flood.

This report identifies and delineates the flood hazard areas along 11 miles of the Little Ossipee River in York County in southern Maine. Drainage area of the study reach is about 185 miles. Flood plain width varies from 500 feet up to a maximum of 1000 feet. Development in the flood plain includes several small towns and recreation areas. No dwellings presently exist in the 100-year flood plain. However, development pressure in the flood plain is projected to take the form of construction of both permanent and seasonal homes in the next four to five years. Streamflow data were gathered from a U.S. Geological Survey gaging station (with a period of record of 36 years) on the Little Ossipee near its mouth at South Limington. Flooding is caused mainly by spring snowmelt and by brief but intense summer rains. Major flooding occurred on the river in March 1936, with a peak discharge of 8,530 cubic feet per second (cfs) downstream of the study area; the highest recorded discharge at the gage on the Little Ossipee River occurred in May 1954 and measured 5,300 cfs. Peak discharge estimates for the 100- and 500-year flood occurrences are 2,970 cfs and 4,690 cfs, respectively, at Newfield Road. This report is intended to provide a technical basis for flood plain management; suggestions include land use planning, flood plain regulation and acquisition, and conservation easements. (Arnold-NC)
W80-00535

FLOOD PLAIN INFORMATION: BAYOU BONFOUCA-BAYOU VINCENT W-14 MAIN DIVERSION CANAL DOUBLOON BRANCH-FRENCH BRANCH, SLIDELL, LOUISIANA AND VICINITY,
Army Engineer District, New Orleans, LA.
Prepared for St. Tammany Parish Police Jury and the St. Tammany Parish Department of Planning and Engineering, Louisiana, December 1971. 54 p, 18 fig, 19 plates, 14 tab.

Descriptors: *Louisiana, *Floods, *Flood profiles, *Storms, *Hurricanes, *Flood stages, *Bayou Bonfouca(LA), Bayou Vincent(LA), *Doubloon Branch(LA), *French Branch(LA), *Slidell(LA), Overland flow, Flooding, Overflow, Indirect flood measurement, Historic floods, Flood data, Peak discharges, Flow duration, Rivers, Standard project flood, W-14 Main Diversion Canal(LA), St. Tammany Parish(LA), Intermediate regional flood.

The study area in the immediate vicinity of Slidell, Louisiana, is part of an ancient delta of the Mississippi River with elevations ranging from a few feet above mean sea level (msl), at its southern limit near Lake Pontchartrain, to approximately 20 feet msl at its northern limits, above the city of Slidell at Interstate Highway 1-12. There are three major stream and canal systems draining the study area, Bayou Vincent (W-13 Main), W-14 Main (locally known asthe Diversion Canal), and Doubloon Branch-French Branch (W-15 Main). The watershed of these three systems is 127 square miles and development in this area ranges from industrial to rural and undeveloped. The study area is subject to flooding from hurricane surges as well as headwater flooding from the various streams in the area. There are very few flood records in the study area; information was gathered through interviews newspaper files and historical documents. The greatest flood occurred on May 18, 1958 when 13.20 inches of rain was recorded in Slidell. The Intermediate Regional Flood (IRF) at the mouth of Bayou Vincent would discharge 7,700 cubic feet per second (cfs), while the Standard Project Flood (SPF) would discharge 11,000 cfs. Duration for headwater or rainfall flooding varies from 20 to 36 hours for the IRF and SPF, respectively, while duration of hurricane flooding is estimated to be 35 hours. There are no existing comprehensive flood control projects that would benefit the entire watershed. There is one project under construction that will reduce hurricane flooding. (Iervolino-NC)
W80-00536

FLOOD PLAIN INFORMATION: OHIO RIVER, HANCOCK COUNTY, KENTUCKY,
Army Engineer District, Louisville, KY.
Prepared for Hancock County Fiscal Court, KY. August 1971. 31 p, 10 fig, 15 plates, 7 tab.

Descriptors: *Kentucky, *Flooding, *Stage-discharge relations, *Hancock County(KY), *Ohio River(KY), Floods, Indirect flood measurement, Maximum probable flood, Flood profiles, Historic floods, Flood data, Flood frequency, Flood stages, Flood peak, Flow duration, Flood damage, Flood protection, Warning systems, Levee, Reservoirs, Intermediate regional flood, Project design flood, Hawesville(KY), Lewisport(KY).

This study relates to flooding of the Ohio River in Hancock County, Kentucky, a distance of approximately 30 miles. Hancock County has a land area of 187 square miles and a 1970 population of 7,080. The majority of flood plain developments are agricultural with some residential development primarily consisteing of the towns of Lewisport and Hawesville. Flood data were collected from U.S. Weather Bureau gages, stream gage records, newspaper accounts of past floods, and historical records and investigations. There are at present no flood plain zoning regulations covering all of Hancock County and only a levee protecting Hawesville has been constructed. The main flood season for the Ohio River is winter and early spring. Most of the flooding is due to heavy rains. The worst flood in Hancock County occurred in January 1937, reaching an elevation of 405.4 feet at Hawesville and 398.8 feet at Lewisport, inundating large portions of both towns. The intermediate Regional Flood would reach a height of 398.95 feet at the Tell City gage. This report provides the basis for further investigations and planning on the part of local governments in arriving at solutions to minimize vulnerability to flood damages. (Coan-NC)
W80-00537

SPECIAL FLOOD HAZARD INFORMATION REPORT: TYGART RIVER, TAYLOR COUNTY, WEST VIRGINIA,
Army Engineer District, Pittsburgh, PA.
Prepared for the Region VI Planning and Development Council, Taylor County Commission, City of Grafton, West Virginia Department of Natural Resources, November 1978. 5 p, 3 tab, 8 plates.

Descriptors: *West Virginia, *Flood forecasting, *Flood profiles, *Flood data, *Flood frequency, *Tygart River(WV), *Tygart Dam(WV), Floods, Flooding, River forecasting, Historic floods, Flood stages, Peak discharges, Flood protection, Dams, Grafton(WV), Park View(WV), Fetterman(WV), 100-year flood, 500-year flood.

This report describes the flood situation along a 20 mile segment of the Tygart River in Taylor County, West Virginia. The flood plain in the study area is relatively narrow; development within the flood plain is residential, commercial and industrial, and is centered around Park View, Grafton and Fetterman. The Tygart Dam, located above Grafton, serves as a flood reduction measure. Data were obtained from stream gages located within and below the study area. Prior to construction of the Tygart Dam in 1938, the highest recorded flood in Taylor County crested at 987 feet above National Geodetic Vertical Datum (NGVD) of 1929, with a discharge of 74,300 cubic feet per second (cfs). No major floods have occurred in Taylor County since completion of the dam. Below the study reach, the greatest flood occurred in 1948, cresting at 873.2 feet above NGVD and discharging 22,500 cfs. At the USGS gage at Carr China at the Tygart outflow, the 100-year flood would crest at 982.30 feet above NGVD, discharging 30,000 cfs, and the 500-year flood would crest at 993.25 feet above NGVD, discharging 70,000 cfs. The report includes high-water profiles and maps showing previously flooded areas along the river. The purpose of this report is to aid in determining flood heights and areas subject to flooding, and is intended to be used as a planning tool for local developers and

planning agencies. In addition, this report is to serve as a basis for further study of flooding on the identified distance of the river. (Iervolino)-NC)
W80-00538

FLOOD PLAIN INFORMATION: OHIO RIVER, BOONE COUNTY, KENTUCKY,
Army Engineer District, Louisville, KY.
Prepared for Boone County Fiscal Court, KY. (1972) 32 p, 11 fig, 16 plates, 6 tab.

Descriptors: *Kentucky, *Flooding, *Stage-discharge relations, *Boone County(KY), *Ohio River(KY), Floods, Indirect flood measurement, Flood profiles, Historic floods, Flood data, Flood frequency, Flood recurrence interval, Flood stages, Peak discharge, Flood peak, Flow duration, Flow characteristics, Flood protection, Warning systems, Intermediate Regional Flood, Project design flood.

This study relates to flooding of the Ohio River in Boone County, Kentucky, a distance of 39.1 miles. Developments in the study area include residential, commercial and industrial facilities. Completion of the Markland Dam, with resultant improvement in commercial navigation facilities and enhancement of recreation potential, has stimulated growth along the riverfront. Flood data were collected from a U.S. Geological Survey stream gage, newspaper accounts, and historic records. Flood damage prevention measures include the upstream Ohio River tributary flood control reservoirs but within the county there are no flood protection works or flood plain regulations. The main flood season for the Ohio River occurs from Jauary to April resulting from general heavy rains. The worst recorded flood in Boone County occurred in January 1937, reaching a height of 508.1 feet and dischaging 894,000 cubic feet per second (cfs). The sustained flood period was 17.5 days, with a water velocity of 6.0 feet per second. The intermediate Regional Flood would reach the same elevation as the historic 1945 flood, which was 497.3 feet with a discharge of 708,000 cfs. This report provides the basic information to allow local governments to minimize vulnerability to flood damages. (Coan-NC)
W80-00539

FLOOD PLAIN INFORMATION: BATON ROUGE, LOUISIANA, NO. 5, CYPRESS BAYOU AND TRIBUTARIES,
Army Engineer District, New Orleans, LA.
Prepared for City of Baton Rouge, LA, November 1976. 41 p, 20 fig, 23 plates, 6 tab.

Descriptors: *Louisiana, *Flooding, *Flood profiles, *Peak discharge, *Cypress Bayou(LA), Floods, Indirect flood measurement, Historic floods, Flood data, Flood frequency, Flood stages, Flood peak, Flow duration, Flow characteristics, State-discharge relations, Flood protection, Flood plain insurance, Warning systems, Building codes, Control structures, Channel improvement, Standard project flood, Intermediate regional flood, Comite River(LA), East Lateral(LA), West Lateral(LA), Baton Rouge(LA).

The study area covered in this report includes portions of East Baton Rouge Parish and Baker subject to flooding from the Comite River, Cypress Bayou and some of their tributaries. Developments in the flood plain of lower Cypress Bayou is semi-rural with a few subdivisions, while development in the flood plain of East Lateral, a tributary of Cypress Bayou, is becoming suburban. Flood data were collected from several stream gaging stations, newspaper files, and historical documents and records. Extensive channel improvements on the Comite River, Cypress Bayou, and East and West Laterals of Cypress Bayou have been made along with the institution of building codes to control flooding. The main flood season in the Cypress Bayou watershed occurs during the winter and spring. The worst recorded flood occurred in April 1967 but no discharge figures are available. The peak discharge for the Intermediate Regional Flood on the Comite River is 34,100 cubic feet per second (cfs), for Cypress Bayou, 7,310 cfs, for the East Lateral, 1,490 cfs. The Standard Project Flood peak discharge for these areas are 50,100 cfs, 9,520 cfs, and 1,650 cfs, respectively. This report provides a suitable basis for flood plain zoning decisions and future land use planning. (Coan)
W80-00540

FLOOD PLAIN INFORMATION: BATON ROUGE, LOUISIANA, NO 4, HURRICANE CREEK, MONTE SANO BAYOU AND TRIBUTARIES,
Army Engineer District, New Orleans, LA.
Prepared for City of Baton Rouge, LA, November 1976. 56 p, 28 fig, 41 plates, 6 tab.

Descriptors: *Louisiana, *Flooding, *Flood profiles, *Flood data, *Peak discharge, *Flood plains, *Baton Rouge(LA), *Hurricane Creek(LA), *Monte Sano Bayou(LA), Floods, Indirect flood measurement, Flood forecasting, Historic floods, Flood stages, Flood peak, Flow duration, Flow characteristics, Stage-discharge relations, Rivers, Flood protection, Flood plain zoning, Flood plain insurance, Warning systems, Building codes, Channel improvement, Standard project flood, Intermediate regional flood, Comite River(LA), Robert Canal(LA).

The study area includes the flood plains of Comite River, Hurricane Creek, and Monte Sano Bayou covering portions of East Baton Rouge. Developments in the flood plain area are both densely residential and commercial, and sparsely settled open space. Flood data were gathered from several U.S. Geological Survey stream gages, newspaper files and historical documents and records. Extensive channel improvements provide most of the flood protection with limited building codes and subdivision ordinances enacted. The main flood season in the Hurricane Creek and Monte Sano Bayou watersheds occurs during the winter and spring. Most of the severe floods result from general heavy rains but some floods in the summer result from intense local thunderstorms. The worst recorded flood in the study area occurred April 29, 1962 on the Comite River and reached an elevation of 44.9 feet mean sea level (msl) with a peak discharge of 20,900 cubic feet per second (cfs). The Intermediate Regional Flood (IRF) peak discharges for the Comite River and Hurricane Creek would be 34,100 cfs and 9,590 cfs, respectively. These floods are expected to reach a height of rise above bankfull of 4.6 feet for the Comite River and 7.0 feet for Hurricane Creek. The IRF peak discharge for Monte Sano Bayou would be 5,790 cfs, reaching a height of 11.9 feet above bankfull stage. The peak discharges for a Standard Project Flood (SPF) on the Comite River, Hurricane Creek and Monte Sano Bayou would be 50,100 cfs, 11,900 cfs, and 6,490 cfs, respectively, with heights above bankfull stage of 7.3 feet, 7.7 feet and 12.6 feet, respectively. This report provides a basis for land use planning and decisions concerning flood plain utilization. (Coan-NC)
W80-00541

GEOMORPHIC STUDY OF UPPER MISSISSIPPI RIVER,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Y. H. Chen, and D. B. Simons.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, No. WW3, Proceedings Paper 14778, p 313-328, August 1979. 7 fig, 1 tab, 6 ref, 2 append.

Descriptors: *Mississippi River, *Geomorphology, *Channel improvement, *Model studies, Mathematical models, Navigation, Rivers, Dams, Dikes, Dredging, Sedimentation, Planning, Inalnd waterways, Backwater, Hydraulics.

In order to estimate the effects of removal of snags hazardous to navigation and construction of dikes, revetment, and locks and dams on the river geomorphology, the past and present geomorphic features of the Upper Mississippi River were studied. The geomorphic features studied included: the river position, river surface area, island surface area, number of islands, riverbed surface area, surface widths, water depth, side channels, and riverbed elevations. The study results indicated that natural and man-induced activities in the last 150 yr have produced subtle changes in the river geomorphology. The low dike fields narrowed the river, created new islands and chutes, and enlarged old islands. Locks and dams have widened the river and increased the number of islands in the pools. It was concluded that 50 yr from now the river scene of the Upper Mississippi River will be essentially as it is today if no major man-made changes or natural events occur. (Sims-ISWS)
W80-00585

A STORAGE ROUTING MODEL BASED ON CATCHMENT GEOMORPHOLOGY,
Wollongong Univ. (Australia). Dept. of Civil Engineering.
M. J. Boyd, D. H. Pilgrim, and I. Cordery.
Journal of Hydrology, Vol. 42, No. 3/4, p 209-230, July 1979. 9 fig, 5 tab, 29 ref.

Descriptors: *Storage, *Routing, *Flood routing, *Model studies, Mathematical models, Rainfall, Excessive precipitation, Precipitation(Atmospheric), Runoff, Hydrographs, Unit hydrographs, Water storage, Drainage, Watersheds(Basins), Streamflow, Geomorphology, Hydrology.

A storage routing model which estimates the runoff hydrograph from a rainfall-excess hyetograph was developed. The model comprised storage elements, each of which represented a catchment sub-area, connected in the same arrangement as the stream network. Different storage elements were used to represent the sub-areas which simply translate rainfall excess to runoff and those which do this and also transmit flow from an upstream area. This model structure permitted the storage parameter of each element to be related to the geomorphological and hydrological characteristics of the catchment. Only one fitted parameter was used in the model; all others were directly related to the catchment and model structures. Initial model development was for linear catchment response which was then extended to the non-linear case. Measurements of catchment non-linearity refer to average values of lag and stream discharge, whereas the non-linear storage-routing equation refers to instantaneous values. The power relations for the two cases were shown to be similar. Application of the model to 10 catchments in eastern New South Wales with a wide range of areas and drainage patterns gave consistent relationships and accurate results. (Sims-ISWS)
W80-00590

SOME DIMENSIONAL CONSIDERATIONS IN THE UNIT HYDROGRAPH THEORY,
Technion-Israel Inst. of Tech., Haifa (Israel). Faculty of Civil Engineering.
M. H. Diskin.
Journal of Hydrology, Vol. 42, No. 3/4, p 199-208, July 1979. 1 fig, 2 tab, 1 append.

Descriptors: *Runoff, *Discharge(Water), *Unit hydrographs, *Model studies, Mathematical models, Rainfall, Excessive precipitation, Precipitation(Atmospheric), Hydrographs, Flow, Hydrology, Data processing, Analytical techniques, Dimensional considerations.

The definition of the unit hydrograph leads to two possible dimensions for its ordinates. They are either the dimension of discharge per unit depth (L sq/T) or that of specific discharge per unit depth (1/T). Depending on the units used, three types of unit hydrographs were identified. The first denoted by w was expressed in units of cu m/s/mm, the second denoted v was in units of cu m/s/sq km/mm, and the third denoted by u was in units of mm/h/mm, or 1/h. The relationships between the various unit hydrographs and the areas enclosed by each curve were outlined. The corresponding unit hydrographs in English units were: w sub e in units of cu ft/s/in, v sub e in cu ft/s/sq mi/in, or v sub a in cu ft/s/acre/in and u in units of in/h/in, or 1/h. The relationships between these various unit hydrographs and between them and those in the metric units were also presented. A relationship between the peak ordinate of the unit hydrograph

and the time to peak was derived by considering the area enclosed by each of the unit hydrographs considered. (Sims-ISWS)
W80-00591

INFLUENCE OF SURFACE ROUGHNESS AND CLOD SIZE AND STABILITY ON SOIL AND WATER LOSSES,
Science and Education Administration, Lafayette, IN.
For primary bibliographic entry see Field 2J.
W80-00593

NOTE ON THE DISTRIBUTION OF FLOOD MAXIMA FOR RANDOM SAMPLE SIZE,
Otago Univ., Dunedin (new Zealand). Dept. of Geography.
W. E. Bardsley, and B. F. J. Manly.
Journal of Hydrology, Vol. 42, No. 1/2, p 187-193, June 1979. 3 tab, 8 ref.

Descriptors: *Floods, *Sampling, *Flood flow, Flood data, Flood frequency, Flood peak, Maximum probable flood, Distribution patterns, Equations, Time, *Flood maxima, *Random sample size, Sample size distribution, Partial duration series, Fixed sample asymptote, Flood exceedances, Distribution function.

The largest flood events observed in fixed time intervals can be interpreted as the largest members of samples of variable size. Determination of the exact distribution of maxima is complicated by the requirement of an explicit expression for the sample size distribution and there are no simple asymptotic expressions for the maxima equivalent to the fixed sample size case. There is some practical value, therefore, in ascertaining situations where the random sample size effect can be disregarded. To this end, a method was given for calculating the maximum error involved in analyzing the flood maxima as if they represented the largest observations from samples of fixed size. If this error can be shown to be small, then the standard fixed sample techniques can be utilized. The method can be applied to obtain the exact maximum error for a specified sample size distribution or, alternatively, an estimate of this error can be obtained from an observed partial duration series. A general condition was established for the maxima from random sample size to tend toward a fixed sample asymptote as the mean sample size increases. (Roberts-ISWS)
W80-00611

AN ANALYSIS OF THE PROCESSES OF RIVER BANK EROSION,
Victoria Univ. of Manchester (England). Geography Div.
For primary bibliographic entry see Field 2J.
W80-00612

IMPORTANCE OF LAKE-RIVER INTERACTION ON SEASONAL PATTERNS IN THE GENERAL CIRCULATION OF KAMLOOPS LAKE, BRITISH COLUMBIA,
Department of the Environment, Vancouver (British Columbia). Inland Water Directorate.
For primary bibliographic entry see Field 2H.
W80-00631

ENVIRONMENTAL OBSERVATIONS OF A RIPARIAN ECOSYSTEM DURING FLOOD SEASON,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
W. J. Mitsch, W. Rust, A. Behnke, and L. Lai.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-104540, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois, Urbana, Research Report 142. August 1979. 69 p, 19 fig, 6 tab, 11 ref, 2 append. OWRT A-099-ILL(1), 14-31-001-9015.

Descriptors: *Wetlands, Flooding, Sedimentation, Riparian ecosystems, *Floodplains.

Dynamics of floodplain wetlands along the Kankakee River in Northeastern Illinois were studied during the Spring flood season of 1979. The study involved hydrology, water chemistry and sedimentation measurements. The wetlands study areas were dominated by silver maple (Acer saccharinum) with river birch (Betula nigra), pin oak (Quercus palustris), America elm (Ulmus americana) and swamp white oak (Q. bicolor) as subdominants. The floodplain forest study site was inundated for 62 to 80 days, depending on location during March - May 1979. Flooding was determined to occur at a river discharge of 4000 to 4500 cfs and the floodplain forest was determined to be under water 66 percent of the years for at least 10 days since 1917. Flooding has not occurred at all in only five years during that period. Approximately 6.2 million cubic meters of water was stored in the entire wetland area, this representing 2.3 percent of the floodwater above bankfull discharge at a downstream location. Water quality during flooding indicated that few spatial patterns existed on different floodplain sites and no differences were seen in the floodplain and main channel water quality of the river. Groundwater showed increasing orthophosphates and decreasing nitrates after floodwater receded. Sedimentation plates placed on the floodplain prior to flooding collected an average of 590 g/sq m of sediments, representing a gross deposition of 4500 metric tons of sediments on the entire wetland area. No consistent spatial pattern of sediment deposition was noted.
W80-00691

THE BIOCENOTIC MODEL,
Landesanstalt fuer Umweltschutz Baden-Wurttenberg, Karlsruhe (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W80-00707

THE USE AND LIMITATIONS OF A TWO-DIMENSIONAL MIXING MODEL FOR RIVERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 5B.
W80-00708

STREAMFLOW GENERATION IN A FORESTED WATERSHED, NEW ZEALAND,
Forest Research Inst. Christchurch (New Zealand).
M. P. Mosley.
Water Resources Research, Vol. 15, No. 4, p 795-806, August 1979. 12 fig, 5 tab, 18 ref.

Descriptors: *Watersheds(Basins), *Forest watersheds, *Streamflow, Flow, Seepage, Dye concentrations, Hydrographs, Hydrology, Runoff, Runoff forecasting, *New Zealand, *Streamflow generation, Channel stormflow generation, Quickflow, Saturated hydraulic conductivity.

A 0.3028-ha watershed has been instrumented to monitor streamflow and subsurface flow through the soil mantle at a variety of topographic locations. The watershed is forested, with steep (35 deg) slopes and shallow (average 55 cm) soils on impermeable Old Man gravels. Data for a number of storms indicated that subsurface flow via 'macropores' (root channels, pipes) and seepage zones in the soil is the predominant mechanism of channel stormflow generation in storms with quickflows greater than about 1 mm. Subsurface flow from all parts of the watershed appears to contribute to stormflow even in very small storms (quickflow of the order of 3% of net precipitation). The saturated hydraulic conductivity of the soil matrix is not a limiting factor on the ability of subsurface flow to generate channel stormflow because dye tracer experiments demonstrate that water may move through macropores (particularly root channels) at rates 2 orders of magnitude greater. However, subsurface flow from lower slope areas contributes to delayed flow; cessation of subsurface flow and streamflow after a drought period is roughly coincident in time. In the study area it appears that streamflow is at almost all times dominated by subsurface flow and that runoff from partial and variable source areas contributes significant quantities of streamflow only during the rising limb of small (less than 1 mm of quickflow) flood hydrographs. (Lee-ISWS)
W80-00724

DRAINAGE NETWORK POWER,
Southampton Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 8E.
W80-00725

AN APPLICATION RUNOFF MODEL STRATEGY FOR UNGAGED WATERSHEDS,
Science and Education Administration, Athens, GA.
D. L. Chery, Jr., C. G. Clyde, and R. E. Smith.
Water Resources Bulletin, Vol. 15, No. 4, p 1126-1145, August 1979. 11 fig, 3 tab, 29 ref.

Descriptors: *Runoff, *Model studies, *Watersheds(Basins), Mathematical models, Costs, Cost comparisons, Computers, Flow, Surface runoff, Overland flow, Rainfall, Precipitation(Atmospheric), Rainfall-runoff relationships, Hydrology, *Kinematic watershed models.

Mathematical models for predicting watershed surface flow responses are available, most of which are elaborate nonlinear numerical surface and channel flow models linked with infiltration models. Such models may be used to make predictions for ungaged areas, assuming an acceptable fitting of the model to the topography and roughness of the real system. For some application purposes, these models are impractical because of their complexity and expensive computer solutions. A procedure was developed that uses a complex model of an ungaged area to derive a simpler parametric nonlinear system model for repetitious simulation with input sequences. The predicted flow outputs were obtained with the simpler model at significant savings of money and time. The procedures for constructing a complex kinematic model of a 40 acre (161,880 sq m) reference watershed and for deriving the simpler system model were outlined. The results of predictions from both models were compared with a selected set of measured events, all having essentially the same initial conditions. Peak discharges ranged from 3 to 118 cu ft/sec (0.085 to 3.34 cu m/sec), which included the largest event of record. The inherent limitations of lumped systems models were demonstrated, including the bias caused by their inability to model infiltration losses after rainfall ceases. Computer costs and times for the models were compared. The derived simple model has a cost advantage when repeated use of a model is required. Such an applications hydrologic model has an engineering tradeoff of reduced accuracy and lumping bias, but it is more economical for certain design purposes. (Sims-ISWS)
W80-00728

STATISTICAL TERMINOLOGY: DEFINITIONS AND INTERPRETATION FOR FLOOD PEAK ESTIMATION,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. H. McCuen.
Water Resources Bulletin, Vol. 15, No. 4, p 1106-1116, August 1979. 1 fig, 20 ref.

Descriptors: *Statistics, *Statistical methods, *Flood peak, *Estimating, Floods, Flood forecasting, Statistical models, Estimating equation, Mathematical models, Hydrology, *Statistical terminology.

Considerable effort is expended each year in making flood peak estimates at both gaged and ungaged sites. Many methods, both simplistic and complex, have been proposed for making such estimates. The hydrologist that must make an estimate at a particular site is interested in the accuracy of the estimate. Most methods are developed using either statistical analyses or analytical optimization schemes. While publications describing these methods often include some statistical measure of goodness-of-fit, the terminology often does

not provide the potential user with an idea of how accurate the estimate is. That is, statistical terminology often is not used properly, which may lead to a false sense of security. The use of the correct terminology will help potential users evaluate the usefulness of a proposed method and will provide a means of comparing different methods. This study provided definitions for terms often used in literature on flood peak estimation and provided an interpretation for these terms. Specific problems discussed included the use of arbitrary levels of significance in statistical tests of hypotheses, the identification of both random and systematic variation in estimates from hydrologic methods, and the difference between accuracy of model calibration and accuracy of prediction. (Sims-ISWS)
W80-00729

EXTENSION OF RIVER FLOW RECORDS IN ARGENTINA FROM LONG TREE-RING CHRONOLOGIES,
Arizona Univ., Tucson. Lab. of Tree-Ring Research.
R. L. Holmes, C. W. Stockton, and V. C. LaMarche, Jr.
Water Resources Bulletin, Vol. 15, No. 4, p 1081-1085, August 1979. 3 fig, 6 ref.

Descriptors: *River flow, *Dendrochronology, *Trees, *Coniferous trees, Correlation analysis, Stream gages, Flow, Streamflow, Rivers, Climates, Climatology, Foreign countries, Foreign research, *Argentina.

Tree-ring chronologies were derived from two coniferous species growing in the foothills of the Patagonian Andes of Argentina, using crossdating and standardization techniques developed by the Laboratory of Tree-Ring Research. Seven of these chronologies were selected, along with data from two long reliable gaging stations to reconstruct annual streamflow for two major rivers extending back to the year 1601. Calibration between tree-ring and river flow data was established using the multivariate technique of canonical analysis. Correlations of 0.73 were obtained between gaged and reconstructed flow for both rivers. These Andean conifers contain good climatic and hydrological information and tree-ring chronology, and calibration techniques are capable of extracting much of this information. (Sims-ISWS)
W80-00731

INFLUENCE OF TURBULENCE ON THE ACCURACY OF DISCHARGE MEASUREMENTS IN NATURAL STREAMFLOWS,
Institute of Civil and Construction Engineering, Split (Yugoslavia). Faculty of Civil Engineering.
O. Bonacci.
Journal of Hydrology, Vol. 42, No. 3/4, p 347-367, July 1979. 9 fig, 4 tab, 7 ref.

Descriptors: *Discharge(Water), *Runoff, *Turbulence, *Streamflow, Model studies, Mathematical models, Simulation analysis, On-site investigations, Measurement, Current meters, Flow, Variability, Fluctuations, Velocity, Hydrology, Measurement accuracy.

The objective of this study was to solve some basic and current problems in the field of practical hydrometry and hydrology. As a matter of fact, the basis of this study was that the problems have been theoretically dealt with, but the results have found practical application. The problem of current meter measurement of discharge in natural streamflows was analyzed as well as the effect of the turbulent fluctuations (pulsations) on the possible accuracy of results obtained by this kind of measurement. Employing the mathematical model based on the results of the velocity distribution in a vertical (as defined by Nikitin) simulation of discharge in a schematized open river flow was effected. By means of the analysis of variance, the influence of the following 4 factors on the measurement accuracy were estimated: (1) the number of velocity measurement points in a vertical; (2) the number of velocity measurement verticals; (3) the position of measurement points along the vertical; and (4) the position of verticals along the cross section. The optimum number of measurement verticals, their position in the cross section, as well as the number and position of the points for measuring the velocity by the current meter were defined. The effect of the possible accuracy of discharge estimations on the accuracy of defining the rating curve was also studied. The original, approximate procedure for estimating the upper limit of the absolute error in discharge measurements was also presented. (Sims-ISWS)
W80-00745

A DIMENSIONALLY HOMOGENEOUS AND STATISTICALLY OPTIMAL MODEL FOR PREDICTING MEAN ANNUAL FLOOD,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Human Settlements Developments.
S. T. Wong.
Journal of Hydrology, Vol. 42, No. 3/4, p 269-279, July 1979. 3 tab, 5 ref.

Descriptors: *Floods, *Flood forecasting, *Model studies, Mathematical models, Regression analysis, Humid areas, Watersheds(Basins), Rainfall, Precipitation(Atmospheric), Drainage, Streams, Streamflow, Hydrology, Principal components analysis.

A combination of dimensional analysis and principal components analysis was employed to deduce a dimensionally homogeneous and statistically optimal least-squares fit estimation equation for predicting mean annual flood in a humid region. Through the application of Buckingham's pi-theorem and principal components analysis, a least-squares fit estimation equation was finally derived. The model so deduced proved to be both dimensionally homogeneous and statistically optimal. The results yielded by the model were not only superior, but also they were more refined than those that were unfolded by an initial study made by the author. (Sims-ISWS)
W80-00747

A STATISTICAL METHOD FOR MODELLING THE FATE OF RAINFALL IN A TROPICAL RAINFOREST CATCHMENT,
James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Geography.
M. Bonell, D. A. Gilmour, and D. F. Sinclair.
Journal of Hydrology, Vol. 42, No. 3/4, p 251-267, July 1979. 7 fig, 3 tab, 20 ref.

Descriptors: *Runoff, *Watersheds(Basins), *Tropical regions, *Australia, *Model studies, Mathematical models, Rainfall, Overland flow, Discharge(Water), Streamflow, Statistics, Statistical methods, Storms, Storm runoff, Rain forests, Mathematics, Hydrographs, Hydrology, Tropical rainforests.

This paper presented a statistical method for translating the lag response between overland flow, stream discharge, and rainfall in a tropical rainforest of northeastern Australia in terms of the disposition of the rainfall on the catchment. The experimental plot was about 0.016 ha in area and was a component of a 26-ha experimental catchment that had characteristic slopes of about 30%. A simple lagged regression model fitted the data well. The results indicated lag responses of 6-12 min between rainfall and overland flow and 12-24 min between rainfall and stream discharge. An explanation of these short and variable lag responses was sought in the discussion of the hydrological processes involved. (Sims-ISWS)
W80-00748

A FINITE-ELEMENT DISTRIBUTED CATCHMENT MODEL, II. APPLICATION TO REAL CATCHMENTS,
King's Coll., London (England). Dept. of Civil Engineering.
A. W. Jayawardena, and J. K. White.
Journal of Hydrology, Vol. 42, No. 3/4, p 231-249, July 1979. 7 fig, 3 tab, 14 ref.

Descriptors: *Runoff, *Watersheds(Basins), *Drainage, *Model studies, Mathematical models, Finite element analysis, Rainfall, Precipitation(Atmospheric), Storms, Storm runoff, Hydrographs, Rivers, Streams, Streamflow, Hydrology.

The analytical basis for a distributed catchment model within the framework of the finite-element method was described in Part I of this paper. In Part II, the authors described a geometrical framework upon which the mathematical model was operated. This flexible framework was based upon the assumption that flow is normal to the topographical contours of the catchment. Thus, the catchment is subdivided into strips which run from the top of slopes to main drainage paths in directions normal to the contours. These, in turn, are then discretized into elements which form the basic components of the finite-element analysis. The proposed discretization and the algorithm were used to simulate several storm hydrographs using data collected from two experimental catchments. The problems, limitations, probable sources of error, and potential applications of the approach were discussed. (See also W77-12798) (Sims-ISWS)
W80-00749

FLOODS OF DECEMBER 1978 IN KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
J. N. Sullavan, F. Quinones, and R. F. Flint.
Geological Survey open-file report 79-977, April 1979. 53 p, 15 fig, 6 tab, 4 ref.

Descriptors: *Floods, *Kentucky, *Flood data, *Flood damage, Streamflow, Peak discharge, Sediment transport, Water quality, Storms, Precipitation(Atmospheric), Flood frequency, Data collections.

In 1978, severe flooding throughout the State of Kentucky occurred from December 3-10 as a result of intense precipitation from two storms. The storms of December 3-5 and December 7-10 produced record peak discharges in several areas throughout central and eastern Kentucky, resulting in damages of nearly 50 million dollars and the loss of five lives. This report summarizes data collected during the floods by the U.S. Geological Survey, Water Resources Division, and other Federal and State agencies in Kentucky. The data include precipitation, streamflow, and water-quality data (including suspended sediment). Estimates of property damages in selected basins are also provided. The information is preliminary and subject to revisions. (Woodard-USGS)
W80-00758

FLOOD PROFILES ALONG THE CEDAR RIVER, KING COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
O. C. Hettick.
Geological Survey Water-Resources Investigations 78-84 (open-file report), 1979. 23 p, 3 fig, 3 tab.

Descriptors: *Flood profiles, *Flood frequency, *Peak discharge, *Flood forecasting, *Regulated flow, Reservoirs, Evaluation, *Cedar River(Wash), King County(Wash).

Flood profiles on the Cedar River, King County, Wash., were developed from 21.1 to 33.65 miles upstream from the mouth for the flood of December 3-4, 1975, and for a 100-year flood. Estimated water-surface elevations during a 100-year flood indicate virtually all the flow would be contained in the river channel. Since 1914, Cedar River flows have been affected by impoundment and release of storage from Chester Morse Lake at river mile 35.6, and since 1901 by diversion for water supply at river mile 21.6. Flood-frequency analysis, based on 62 years of regulated flows (period 1915-76), indicate the 100-year flood would have a discharge of 8,600 cubic feet per second at river mile 23.4 and 6,870 cubic feet per second at river mile 33.2. The highest flood since regulation began occurred December 3 and 4, 1975, and was 7,930 cubic feet per second at river mile 23.4 and 6,860 cubic feet per second at river mile 33.2. Recurrence interval of this flood is about 70 years at river mile 23.4 and about 100 years at mile 33.2 under present conditions of storage and regulation. (Woodard-USGS)
W80-00760

TECHNIQUE FOR ESTIMATING THE MAGNITUDE AND FREQUENCY OF FLOODS IN ST. LOUIS COUNTY, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
D. W. Spencer, and T. W. Alexander.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 245, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-139, November 1978. 23 p, 10 fig, 4 tab, 20 ref.

Descriptors: *Flood forecasting, *Peak discharge, *Regression analysis, *Urban hydrology, *Rural areas, Rainfall-runoff relationships, Frequency analysis, Streamflow, Flow rates, Design flood, Equations, Drainage areas, Permeability, Small watersheds, *St. Louis County(MO).

Equations and nomographs in this report can be used to estimate peak flood discharges having recurrence intervals up to 100 years in rural and urban areas of St. Louis County, MO. The basin characteristics significant at the 5-percent probability level were drainage area and percentage imperviousness. Drainage area can be measured from maps, while percentage of imperviousness can either be measured from aerial photographs or estimated from land-use projections. These equations are based upon the analysis of hydrologic data collected at 30 continuous-recording gaging stations with drainage areas ranging from 0.8 to 39.0 square miles, and with impervious areas ranging from 1 to 32 percent. (Woodard-USGS)
W80-00762

EFFECTS OF URBANIZATION ON THE MAGNITUDE AND FREQUENCY OF FLOODS IN NORTHEASTERN ILLINOIS,
Geological Survey, Champaign, IL. Water Resources Div.
For primary bibliographic entry see Field 4C.
W80-00769

STATISTICAL SUMMARIES OF ARIZONA STREAMFLOW DATA,
Geological Survey, Tucson, AZ. Water Resources Div.
T. W. Anderson, and N. D. White.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 354, Price codes: A18 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-5, January 1979. 416 p, 1 fig, 2 tab, 1 ref.

Descriptors: *Streamflow, *Flow rates, *Gaging stations, *Arizona, *Hydrologic data, Peak discharge, Flood frequency, Flow duration, Low flow, High flow, Average flow, Statistical methods.

Statistical summaries of streamflow data are presented for 143 gaging stations in Arizona. The summaries are given for all active streamflow-gaging stations at which flow is unregulated, for discontinued stations that have at least 5 years of record, and for a few stations at which the flow is partly regulated. Included in the summaries are (1) log-Pearson type III flood-frequency data for selected streamflow-gaging stations, (2) annual peak discharges and gage heights and annual volumes, (3) duration tables of daily discharges, (4) lowest mean discharges, (5) highest mean discharges, (6) statistics on normal monthly mean discharges, and (7) statistics on normal annual mean discharges. (Woodard-USGS)
W80-00771

2F. Groundwater

GROUND-WATER MANAGEMENT TECHNIQUES FOR THE CONTROL OF SALT-WATER ENCROACHMENT IN GULF-COAST AQUIFERS, A SUMMARY REPORT,
Geological Survey of Alabama, Montgomery.
G. R. Walter, R. E. Kidd, and G. M. Lamb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-102965, Price codes: A05 in paper copy, A01 in microfiche. Report, 1979, 84 p, 10 fig, 4 tab. OWRT B-073-ALA(1).

Descriptors: *Saline water encroachment, *Groundwater management, Numerical models, Aquifers, Gulf Coast.

The fresh ground-water resources of the Gulf Shores area of Alabama occur in four principal aquifers. In order of increasing depth, these are designated the Beach Sand aquifer, the Gulf Shores aquifer, the 350-Foot aquifer, and the 500-Foot aquifer. The 350-Foot aquifer and the 500-Foot aquifer contain fresh water at the coastline and may contain fresh water for some distance beneath the Gulf of Mexico. Only in the Beach Sand aquifer can the cases of salt-water contamination be unequivocably attributed to seawater encroachment. Based on the results of numerical modeling and interpretation of the water chemistry, the cases of contamination in the Gulf Shores aquifer may be due to leakage of saline water around well bores, leakage from confining beds and movement of pockets of relic salt water within the aquifer rather than lateral seawater encroachment.
W80-00490

SOURCES, TRANSPORTATION AND UTILIZATION OF DISSOLVED ORGANIC MATTER IN GROUNDWATER AND STREAMS,
Department of Fisheries and Environment, Burlington (Ontario).
P. M. Wallis.
Kananaskis Centre for Environmental Research, Calgary University, Alberta, Canada. Inland Waters Directorate, Water Quality Branch, Ottawa, Canada, 1979. Scientific Series No. 100, 1979. 49 p, 20 tab, 34 fig, 85 ref.

Descriptors: *Marmot Basin(Ontario), *Dissolved solids, *Surface-groundwater relationship, *Groundwater movement, *Dissolved organic matter, Groundwater runoff, Soil water movement, Subsurface flow, Saturated flow, Unsaturated flow, Laurel Creek(Ontario), Subsurface waters, Hydrology, Streams.

This report describes primarily the hydrology of the Marmot Basin, located approximately 80 km west of Calgary, Alberta, Canada, and the transportation of dissolved organic matter (DOM). Experiments were also undertaken at a site near Leamington, Ontario, in Laurel Creek near Waterloo, and in the laboratory. DOM enters the stream from groundwater, throughfall and precipitation, and from the leaching of particulate organic matter. In the Marmot Basin almost all groundwater is discharged by the streams draining the catchment area because of the presence of bedrock of low permeability. Rainfall dripping through vegetation contains significantly more DOM than does precipitation sampled in the open. In the Marmot Basin maximum stability of DOM is found in streams and maximum variation is found in groundwater. Most of the DOM resulting from litter fall is consumed terrestrially and only a small amount of highly refractory material is exported by the streams. The estimated transport rate of groundwater in the Marmot Basin in the unsaturated zone is 0.017 m/day and in the saturated zone it is 0.14 m/day; it takes groundwater about 10 years on the average to reach the stream. (Iervolino-NC)
W80-00530

CASING AND LEAK DEPTHS, AND SOLUTE TRAVEL TIMES TO WELLS,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W80-00579

GROUND WATER REPLENISHMENT FROM RIVERFLOW,
Lincoln Coll. (New Zealand). Dept. of Agricultural Engineering.
B. D. van't Woudt, J. Whittaker, and K. Nicolle.
Water Resources Bulletin, Vol. 15, No. 4, p 1016-1027, August 1979. 9 fig, 3 ref.

Descriptors: *Groundwater recharge, *Induced infiltration, *River flow, Underflow, Groundwater movement, River beds, Wells, Permeability, Aquifers, Seepage, Water levels, Water table, Maps, Measurement, Hydraulic gradient, New Zealand, Piezometric surface maps.

Groundwater contours and gradients were determined within and adjacent to a gravelly riverbed with about 100 m active channel width and about 800 m floodplain width during low flow, making use of about 60 shallow dug wells and one deeper cased well. Groundwater slopes away from the riverbed to the south and slopes to the riverbed from the north. Replenishment of groundwater to the south is past a 'shell,' a zone of low permeability at the margin of and below the riverbed, (1) into a shallow aquifer from 'sideway-spill-over,' and (2) into an underlying aquifer that is seemingly confined by the 'shell.' Seepage from river channels to underflow takes place all along channel lengths except below riffles where the flow direction is reversed. Half the seepage to underflow is lost to groundwater replenishment. Underflow seems to constitute merely a few percent of total riverflow but makes a disproportionate contribution to groundwater replenishment. (Visocky-ISWS)
W80-00604

ON THE GROWTH OF INSTABILITIES IN GROUNDWATER DUE TO TEMPERATURE AND SALINITY GRADIENTS,
Technion--Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
H. Rubin, and C. Roth.
Advances in Water Resources, Vol 2, No 2, p 69-76, June 1979. 6 fig, 12 ref.

Descriptors: *Groundwater movement, *Thermocline, *Salinity, Buoyancy, Aquifers, Flow, Heat transfer, Heat flow, Thermal water, Temperature, Convection, Diffusion, Hydraulic gradients, Boundary processes, Hydrodynamics, Numerical analysis, *Thermohaline convection, *Instabilities, *Gradients.

A combination of temperature and salinity distribution in an aquifer may induce various types of hydrodynamic instabilities. It was assumed that the aquifer can be represented by an idealized model of a saturated porous layer, bounded on top and bottom by impermeable boundaries at which the temperature and salinity are constant. In stable and unperturbed conditions, the fluid flows through this layer uniformly in the horizontal direction owing to the hydraulic gradient. By linear stability analysis, it was found that three different mechanisms may lead to instability of the flow field: (1) buoyancy forces may induce convection currents (thermohaline convection), (2) the difference between the rate of heat and salinity diffusion may induce oscillations (overstable motions), and (3) the difference between the velocity of propagation of heat and of salinity fronts may induce oscillations. The effect of mechanism (3) varies according to the type of aquifer. An aquifer in which the fluid is initially at rest is not affected at all by mechanism (3). In an aquifer of limited length, subject to hydraulic flow, mechanism (3) limits the growth of instabilities to planes perpendicular to the hydraulic gradient. In an aquifer of unlimited length mechanism (3) may completely neutralize the stabilizing effect of the salinity gradient and lead to thermohaline convection in planes parallel to the hydraulic gradient. Calculations of heat transfer through various types of aquifer by applying numerical simulations were presented. (Visocky-ISWS)
W80-00605

FOUNDATION THEORIES OF SOLUTE TRANSPORT IN POROUS MEDIA: A CRITICAL REVIEW,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 2A.
W80-00606

MODELING GROUNDWATER FLOW FIELDS CONTAINING POINT SINGULARITIES: A TECHNIQUE FOR SINGULARITY REMOVAL,

Stanford Univ., CA. Dept. of Civil Engineering.
R. J. Charbeneau, and R. L. Street.
Water Resources Research, Vol. 15, No. 3, p 583-594, June 1979. 8 fig, 20 ref, 2 append. EPA-R-804431.

Descriptors: *Finite element analysis, *Numerical analysis, *Porous media, *Anisotropy, *Hydrodynamics, Groundwater, Wells, Leakage, Analysis, Heterogeneity, Galerkin technique, Green's functions.

Artificial recharge of groundwater resources through wells leads to a need for computer simulation of the hydraulics and transport of contaminants in a flow field. The basic numerical technique used is the Galerkin finite element method. Greatly improved accuracy of the simulation near wells is achieved first by removing the singular behavior of the flow with an analytic solution for the near-well zone, second by solving the remaining nonsingular problem, and third by combining the results. The resulting solutions compare favorably with known analytic solutions for confined and leaky aquifers (both isotropic and anisotropic). No additional computation time is required for this method compared to standard finite element methods programs. The resulting combined velocity fields are accurate enough throughout the flow field for direct use in contaminant transport simulations. (Adams-ISWS)
W80-00609

EFFECTS OF IN-TRANSIT WATER ON GROUNDWATER MOUNDS BENEATH CIRCULAR AND RECTANGULAR RECHARGE AREAS,
Colorado State Univ., Fort Collins. Engineering Research Center.
N. V. Ortiz, D. W. Zachmann, D. B. McWhorter, and D. K. Sunada.
Water Resources Research, Vol. 15, No. 3, p 577-582, June 1979. 4 fig, 14 ref.

Descriptors: *Groundwater movement, *Groundwater recharge, *Storage, *Recharge ponds, Analytical techniques, Unsteady flow, Infiltration, Unsaturated flow, Porous media.

Analytical solutions, accounting for the reduction in storage capacity caused by in-transit water, were presented for the growth of groundwater mounds in an unconfined aquifer in response to uniform deep percolation from a rectangular and circular recharging area. The solution for the circular case was obtained by integrating the solution for the analogous case of heat flow in a composite cylindrical region with respect to time. In the rectangular case, the solution was obtained by a product of two functions representing the solution for the instantaneous addition of a recharge slug over a long strip and integrating with respect to time. The aquifer is homogeneous, isotropic, infinite in areal extent, and resting on a horizontal impermeable base. Dimensionless curves were presented to afford a relatively simple means for the analysis of the growth of groundwater mounds. (Adams-ISWS)
W80-00610

NATURAL CONTROL OF THE CHEMICAL COMPOSITION OF WATER DURING THE INFILTRATION PROCESS--FIRST RESULTS (ACQUISITION DE LA COMPOSITION CHIMIQUE DE L'EAU AU COURS DE L'INFILTRATION EN MILIEU NATUREL--PREMIERS RESULTATS D'UNE ETUDE EXPERIMENTALE),
Bureau de Recherches Geologiques et Minieres, Orleans (France).
For primary bibliographic entry see Field 5B.
W80-00719

COMPUTATION OF THE ADVANCEMENT OF GROUNDWATER POLLUTION DUE TO PETROLEUM PRODUCTS ORIGINATING FROM A KNOWN SOURCE OF CONTAMINATION (LE CALCUL DE LA PROPAGATION DE LA POLLUTION DES EAUX SOUTERRAINES PAR DES MATERIAUX HUILEUX, PROVENANTS D'UNE SOURCE DE LA POLLUTION CONNUE),
Vyzkumny Ustav Vodohospodarsky, Bratislava (Czechoslovakia).
For primary bibliographic entry see Field 5B.
W80-00720

THE APPLICATION OF A DIGITAL MODEL FOR EVALUATING THE BEDROCK WATER RESOURCES OF THE MAUMEE RIVER BASIN, NORTHWESTERN OHIO,
California Univ., Livermore. Lawrence Livermore Lab.
T. G. Naymik.
Ground Water, Vol. 17, No. 5, p 438-445, September-October 1979. 13 fig, 13 ref. DOE W-7405-Eng-48.

Descriptors: *Groundwater, *Water levels, *Withdrawal, *Ohio, *Indiana, *Model studies, Mathematical models, Computer models, Geology, Hydrology, Aquifers, Drawdown, Pumping, Water resources, Water supply, *Maumee River Basin(OH).

Increasing population and industrial development in northwestern Ohio indicated the need for an evaluation of the bedrock groundwater resources of the region. A digital groundwater model was designed and used as a tool for predicting water level declines resulting from projected groundwater withdrawal. Potentiometric surfaces, keyed to historic, accelerated, and peak projected groundwater withdrawals, were predicted by decades to the year 2036. These withdrawals at the calculated rates will cause severe overdrafts at Lima, Toledo, and Findlay, Ohio, and at Ft. Wayne, Indiana, by the year 2036. (Sims-ISWS)
W80-00726

A METHOD OF AQUIFER TESTING AND ITS APPLICATION TO AN ANISOTROPIC INHOMOGENEOUS MULTIPLE AQUIFER SYSTEM,
Geological Survey of Australia, Melbourne. Dept. of Minerals and Energy.
M. Riha.
Ground Water, Vol. 17, No. 5, p 423-428, September-October 1979. 7 fig, 14 ref.

Descriptors: *Aquifer testing, *Aquifers, *Aquifer systems, *Australia, Testing, Groundwater, Wells, Drilling, Groundwater movement, Transmissivity, Isotropy, Hydraulic properties, Pollutants, Path of pollutants, Water pollution, *Melbourne(Australia), Aquifer testing methods.

A new method of testing anisotropic, inhomogeneous multiple aquifer systems makes use of small diameter bore construction techniques and enables simultaneous testing of superposed aquifers and aquitards (aquicludes). Because of the low cost of the method, the hydraulic properties of the multiple aquifer system can be determined at many sites distributed throughout the area of interest, enabling simulation of the local and regional groundwater flow conditions and other hydrological characteristics of the system. Since its development in 1964, the technique improved and was employed in groundwater investigations. Data and results from the inhomogeneous, anisotropic multiple aquifer system west of Melbourne were given. (Sims-ISWS)
W80-00727

EVAPORATION FROM VEGETATION IN LANDSCAPES DEVELOPING SECONDARY SALINITY USING THE VENTILATED-CHAMBER TECHNIQUE, I. COMPARATIVE TRANSPIRATION FROM JUVENILE EUCALYPTUS ABOVE SALINE GROUNDWATER SEEPS,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
For primary bibliographic entry see Field 2I.
W80-00755

DIGITAL MODEL OF THE HOLLISTER VALLEY GROUND-WATER BASIN, SAN BENITO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-00756

GROUND-WATER APPRAISAL FOR THE COMMUNITY OF KIRYAS JOEL, ORANGE COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2A.
W80-00759

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1978,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 4D.
W80-00764

2G. Water In Soils

SOURCES, TRANSPORTATION AND UTILIZATION OF DISSOLVED ORGANIC MATTER IN GROUNDWATER AND STREAMS,
Department of Fisheries and Environment, Burlington (Ontario).
For primary bibliographic entry see Field 2F.
W80-00530

SOIL WATER IN COARSE FRAGMENTS,
Kentucky Agricultural Experiment Station, Lexington. Dept. of Agronomy.
C. T. Hanson, and R. L. Blevins.
Soil Science Society of America Journal, Vol. 43, No. 4, p 819-820, July-August 1979. 1 tab, 4 ref.

Descriptors: *Soil water, *Sandstones, *Shales, Available water, Field capacity, Wilting point, Soils, Soil types, Rocks, Soil-water-plant relationships, Soil science, Stony soils, Coarse fragments.

The amount of availability of water contained in coarse fragments is often considered to be negligible, but availability of water may in fact play an important role in the water relations of soils containing numerous coarse fragments. The objective of this study was to measure the availability of water contained in two contrasting types and several size fractions of fragments. Field capacity, -15 bar potential, and wilting point (WP) measured by plant extractions were made on sandstone fragments from the surface layers of Cutshin soil and shale fragments from a Colyer soil. The sandstone fragments contained about 11% available water by volume, and the shaly fragments contained 23% available water by volume based on WP measurements by plant removal in the greenhouse. The -15 bar potential determined in the laboratory compared closely with WP measured by plant removal for the sandstone fragments, but the -15 bar potential indicated higher levels of moisture retained in the shale fragments than WP as determined in the greenhouse. (Sims-ISWS)
W80-00592

INFLUENCE OF SURFACE ROUGHNESS AND CLOD SIZE AND STABILITY ON SOIL AND WATER LOSSES,
Science and Education Administration, Lafayette, IN.
For primary bibliographic entry see Field 2J.
W80-00593

ABSORPTION OF WATER BY SOIL: THE CONSTANT FLUX BOUNDARY CONDITION,
Commonwealth Scientific and Industrial Research Organization, Canberra City (Australia). Div. of Environmental Mechanics.
I. White, D. E. Smiles, and K. M. Perroux.
Soil Science Society of America Journal, Vol. 43, No. 4, p 659-664, July-August 1979. 8 fig, 1 tab, 18 ref.

Descriptors: *Soil water, *Absorption, *Diffusion, *Mathematical models, Model studies, Soils, Infil-

tration, Steady flow, Moisture content, Wetting, Soil science, Flux-concentration relations.

Absorption of water into soil as the result of a constant flux condition at the soil surface was examined. Experiments for a fine sand showed that the surface water content, movement of the wetting front, and the water content profiles may be predicted from the soil water diffusivity function using the notion of the flux-concentration relation of Philip. Reduced space and time variables X = (V sub o)x and T = (V sub o) sq t were introduced. Use of these variables greatly simplifies treatment of the system and reveals that the surface water content and the reduced position of the wetting front are uniquely defined by T, while the water content profiles at any value of T are unique in terms of X. (See also W74-02464) (Sims-ISWS)
W80-00596

NATURE AND PROPERTIES OF WATER IN MONTMORILLONITE-WATER SYSTEMS,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
P. F. Low.
Soil Science Society of America Journal, Vol. 43, No. 4, p 651-658, July-August 1979. 7 fig, 1 tab, 30 ref.

Descriptors: *Groundwater, *Montmorillonite, *Water properties, *Model studies, Mathematical models, Chemicals, Water chemistry, Clays, Lithium, Sodium, Thermal capacity, Hydrogen bonding, Viscosity, Thermodynamics.

Data were presented on several properties of water in montmorillonite-water systems. The data indicated that these properties differ from the same properties of bulk water because of differences in intermolecular bonding. Also, it was found that the value, J, of each property is described by the general equation J = J(o) exp beta/(m sub w/m sub m) in which J(o) is the value of the given property in pure bulk water, m sub w/m sub m is the mass ratio of water to montmorillonite, and beta is a constant. The proposal was made that, since all of the water properties obey a common equation, their deviation from the corresponding properties of bulk water must be caused by a common factor. By making appropriate substitutions for m sub w/m sub m and analyzing the resulting equations, the common factor was shown to be interaction of the water with the surfaces of the montmorillonite layers. The nature of this interaction, and ways in which it might affect intermolecular bonding, were discussed. (Sims-ISWS)
W80-00597

RELATIONS BETWEEN GEOMETRICAL PROPERTIES OF GLASS BEADS MEDIA AND THEIR MAIN PSI(THETA) HYSTERESIS LOOPS,
Tunis Univ. (Tunisia). Dept. of Hydraulics.
Ch. Laroussi, and L. W. De Backer.
Soil Science Society of America Journal, Vol. 43, No. 4, p 646-650, July-August 1979. 7 fig, 1 tab, 20 ref.

Descriptors: *Hysteresis, *Porous media, *Pores, Laboratory tests, Data processing, Wetting, Drying, Drainage, Moisture content, Soil science, Glass beads, Pore size.

A main hysteresis loop in the volumetric water content (theta)-suction (psi) relation was determined experimentally for each of seven narrow size fractions of glass beads. Geometrical properties of these media were separately obtained with a Purcell apparatus based on mercury intrusion. A linear relation between the mean radius of beads and the mean radius of pores was established. A computational model was established to relate the main hysteresis loops of porous media to their geometrical properties. As a consequence a diagram expressed in nondimensional variables psi* and theta* was proposed to predict the main hysteresis loop of a similar porous medium whose geometrical properties are deduced by similitude from one of the explored fractions. (Sims-ISWS)
W80-00598

A MODIFIED PERMEAMETER FOR MEASURING HYDRAULIC CONDUCTIVITY OF SOILS,
Gezira Agricultural Research Station, Wad Medani (Sudan).
A. E. Fadl.
Soil Science, Vol. 128, No. 2, p 126-128, August 1979. 3 fig, 1 tab, 3 ref.

Descriptors: *Hydraulic conductivity, *Soil properties, *Permeameters, *Laboratory tests, Physical properties, Soil physical properties, Permeability, Equipment, Instrumentation, Soils, Soil water, Soil water movement, Soil science.

A modified apparatus that permits measurement of hydraulic conductivity of undisturbed soil cores in the laboratory was described. In this technique, the two traditional errors, i.e., side flow and destruction of soil structure, were simultaneously controlled. The results obtained were significantly lower and more realistic than those of the traditional technique. (Sims-ISWS)
W80-00614

USE OF FLUORESCENT DYES TO MARK THE PATHWAYS OF SOLUTE MOVEMENT THROUGH SOILS UNDER LEACHING CONDITIONS: 2. FIELD EXPERIMENTS,
Reading Univ. (England). Dept. of Soil Science.
U. Omoti, and A. Wild.
Soil Science, Vol. 128, No. 2, p 98-104, August 1979. 9 fig, 9 ref.

Descriptors: *Solutes, *Soil water, *Soil water movement, On-site investigations, Dyes, Fluorescent dye, Photography, Ultraviolet radiation, Irrigation, Rainfall, Chlorides, Soils, Soil science, Pyranine, Fluorescein.

Fluorescein and pyranine were used as solute markers in field experiments under irrigation and under winter rainfall. Dye distribution was recorded by ultraviolet photography and was also measured from analyses of soil extracts. Ultraviolet photographs showed uneven horizontal distribution of fluorescein. The main causes were (1) earthworm channels, which appeared to be more important for solute transport under irrigation than under winter rainfall; (2) fissures about 0.05 to 0.10 millimeters wide; and (3) loosely packed soil with varied pore sizes. Although the dye was adsorbed by soil, the vertical distribution followed a similar pattern to that of chloride, suggesting that it was conducted down the same channels as more mobile solutes. (Sims-ISWS)
W80-00615

PHYSICAL CONDITION OF A DAVIDSON CLAY LOAM AFTER FIVE YEARS OF HEAVY POULTRY MANURE APPLICATIONS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
R. R. Weil, and W. Kroontje.
Journal of Environmental Quality, Vol 8, No 3, p 387-392, July-September 1979. 5 fig, 4 tab, 24 ref.

Descriptors: *Soil physical properties, *Farm wastes, *Poultry, Soil moisture, Infiltration, Aggregates, Bulk density, Soil structure, Soils, Soil properties, Invertebrates, Soil water, Soil water movement, Hydraulic conductivity, Soil science, Poultry manure.

Little information is available on how soil physical properties are affected by very heavy poultry manure applications often associated with concentrated poultry production. In this study, after 5 years of applying up to 110 metric tons of poultry manure/ha per year to corn plots, the physical condition of the manured plots differed markedly from that of the unmanured controls. During the spring, the activity of soil invertebrates created a highly channelized and aggregated structure in the surface soil. Plowlayer bulk density was reduced by the poultry manure from 1.1 to 0.8 g/cu cm, and the percentage water-stable aggregates increased from 73 to nearly 94%. About half of the variability in bulk density could be accounted for by differences in soil organic matter contents. The manured plots were generally more moist in the plow layer, especially in spring and early summer when a perched water table at a depth of 20 cm was caused by a water-repellent plowsole layer of partially decomposed manure. In the spring, this layer resulted in infiltration rates on the manured plots as low as 0.02 cm/hour compared to a mean of 12.1 cm/hour on the controls. In November, the infiltration rate of the manured plots rose to 57 cm/hour due to the activities of earthworms. The manured plots held nearly 42% moisture at 0.1 bar tension as compared to 32% for the control plots. Incorporation of poultry manure by means other than moldboard plowing might avoid the creation of a plowsole manure layer which counteracts the potentially beneficial effects of the manure on soil structure and water-holding capacity. (Sims-ISWS)
W80-00620

NATURAL CONTROL OF THE CHEMICAL COMPOSITION OF WATER DURING THE INFILTRATION PROCESS--FIRST RESULTS (ACQUISITION DE LA COMPOSITION CHIMIQUE DE L'EAU AU COURS DE L'INFILTRATION EN MILIEU NATUREL--PREMIERS RESULTATS D'UNE ETUDE EXPERIMENTALE),
Bureau de Recherches Geologiques et Minieres, Orleans (France).
For primary bibliographic entry see Field 5B.
W80-00719

COMPUTATION OF THE ADVANCEMENT OF GROUNDWATER POLLUTION DUE TO PETROLEUM PRODUCTS ORIGINATING FROM A KNOWN SOURCE OF CONTAMINATION (LE CALCUL DE LA PROPAGATION DE LA POLLUTION DES EAUX SOUTERRAINES PAR DES MATERIAUX HUILEUX, PROVENANTS D'UNE SOURCE DE LA POLLUTION CONNUE),
Vyzkumny Ustav Vodohospodarsky, Bratislava (Czechoslovakia).
For primary bibliographic entry see Field 5B.
W80-00720

SIMULATION MODEL OF THE EVOLUTION OF THE CHEMICAL COMPOSITION OF A MINERAL-SOLUTION SYSTEM AND ITS APPLICATIONS (MODELE DE SIMULATION DE L'EVOLUTION DE LA COMPOSITION CHIMIQUE D'UN SYSTEME MINERAUX-SOLUTION ET SES APPLICATIONS),
Groupement d'Etudes et de Realisations des Societes d'Amenagement Regional, Nimes (France).
For primary bibliographic entry see Field 5A.
W80-00721

PREDICTING HYSTERETIC EFFECTS IN EVAPORATION FROM BARE SOIL,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
For primary bibliographic entry see Field 2D.
W80-00732

BEST WAYS TO DEWATER DREDGED MATERIAL,
Oklahoma State Univ., Stillwater. Dept. of Geotechnical Engineering.
T. A. Haliburton.
Civil Engineering--American Society of Civil Engineers, Vol. 49, No. 8, p 57-61, August 1979. 7 fig, 1 tab.

Descriptors: *Vacuum drying, *Dewatering, *Dredging, Sediment transport, Evaporation, Spoil banks, Trenches, Disposal, Soil moisture, *Dredged material, *Dewatered dredged material, Spoil, Trenching, Diked disposal area, Surface trenching, Trenching equipment, Vacuum well points.

Left to its own devices, fine-grained dredged material placed in confined disposal areas reaches an equilibrium water content near its Atterberg liquid limit. The high water content of such dredged material effectively prohibits its use in any productive manner, and storage of the liquid fraction reduces available volume for future dredged material disposal. Various literature and laboratory

studies, followed by field experiments, were conducted to develop technically feasible, operationally practical, and cost-effective methods for removing excess water from confined dredged material and reture it to normal soil consistency. Progressive trenching, to remove ponded surface water from the site and to enhance evaporative drying, and various types of underdrainage dewatering were found to satisfy the selection criteria. Dewatering by vacuum well points, crust mixing and agitation, and electro-osmosis was not satisfactory. (Roberts-ISWS)
W80-00733

MEASUREMENT OF APPARENT ELECTRICAL CONDUCTIVITY OF SOILS BY AN ELECTROMAGNETIC INDUCTION PROBE TO AID SALINITY SURVEYS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
E. de Jong, A. K. Ballantyne, D. R. Cameron, and D. W. L. Read.
Soil Science Society of America Journal, Vol. 43, No. 4, p 810-812, July-August 1979. 2 fig, 1 tab, 5 ref.

Descriptors: *Soils, *Electrical conductance, *Salinity, Instrumentation, Equipment, On-site investigations, Surveys, Electromagnetic waves, Electronic equipment, Evaluation, Soil properties, Irrigation, Salts, Soil science, Soil electrical conductivity, Salinity measurement, Soil salinity, Electromagnetic induction probes, Salinity surveys.

A noncontacting soil resistivity probe, based on electromagnetic induction, was used to measure soil salinity. Good correlations were obtained between the apparent bulk soil conductivity measured by the instrument and the electrical conductivity of saturated paste extracts or the bulk electrical conductivity measured by the Wenner four-probe method. The electromagnetic induction technique provided less detailed information on salinity changes with depth than the other methods, but was faster and can provide a continuous record of salinity changes along a transect. (Sims-ISWS)
W80-00750

INEXPENSIVE FOUR-ELECTRODE PROBE FOR MONITORING SOIL SALINITY,
Science and Education Administration, Riverside, CA. Salinity Lab.
J. D. Rhoades.
Soil Science Society of America Journal, Vol. 43, No. 4, p 817-818, July-August 1979. 3 fig, 10 ref.

Descriptors: *Soils, *Salinity, *Electrical conductance, Equipment, Electronic equipment, Surveys, Monitoring, Irrigation, Infiltration, Soil water, Salts, Soil properties, Soil science, Soil electrical conductivity, Earth resistivity, Four-probe salinity probes, Salinity measurement.

Description was given of the construction and use of an inexpensive four-electrode probe suitable for permanent installations and for in situ monitoring of soil salinity. Data illustrative of its use were presented. (Sims-ISWS)
W80-00751

A COMPACT, LOW-COST CIRCUIT FOR READING FOUR-ELECTRODE SALINITY SENSORS,
Science and Education Administration, Riverside, CA. Salinity Lab.
R. S. Austin, and J. D. Rhoades.
Soil Science Society of America Journal, Vol. 43, No. 4, p 808-810, July-August 1979. 3 fig, 2 ref.

Descriptors: *Soils, *Electrical conductance, *Salinity, Instrumentation, Equipment, Electronic equipment, Surveys, Soil properties, Salts, Irrigation, Electronics, Electrical engineering, Soil science, Soil electronical conductivity, Salinity measurement, Soil salinity, Four-probe salinity sensors.

An electrical circuit was described that uses a minimal number of components to measure soil electrical conductivity using the four-electrode salinity sensor. The portable circuit is compact, inexpensive, reliable, and easy to construct. (Sims-ISWS)
W80-00752

A GALERKIN IN TIME, LINEARIZED FINITE ELEMENT MODEL OF 2-DIMENSIONAL UNSATURATED POROUS MEDIA DRAINAGE,
Iowa State Univ., Ames. Dept. of Agronomy.
J. H. Cushman, D. Kirkham, and R. F. Keller.
Journal of the Soil Science Society of America, Vol. 43, No. 4, p 638-641, July-August 1979. 8 fig, 7 ref. NSF ENG 75-19394.

Descriptors: *Drainage, *Soils, *Mathematical models, *Finite element analysis, Unsteady flow, Unsaturated flow, Time, Seepage, Porous media, Equations, *Two-dimensional flow, *Galerkin method, Soil columns.

Two-dimensional drainage in porous media by a modified finite element technique was examined. This technique consists of using Galerkin's method on the temporal as well as the spatial dimensions and coupling it with a simple linearizing scheme (considering physical properties constant over individual elements). This method was applied to four separate drainage problems, two of which have been studied previously. Results compared well with both of the previous studied problems. (Visocky-ISWS)
W80-00753

PHYSICAL COMPONENTS OF THE DIFFUSIVITY COEFFICIENT,
Louvain Univ. (Belgium). Dept. of Genie Rural.
R. S. Malik, C. Laroussi, and L. W. De Backer.
Journal of the Soil Science Society of America, Vol. 43, No. 4, p 633-637, July-August 1979. 7 fig, 2 tab, 15 ref.

Descriptors: *Diffusivity, *Viscosity, *Pores, *Porous media, Aqueous solutions, Surface tension, Capillary action, Wetting, Moisture content, Model studies, Laboratory tests, Pore size, Glass beads, Heat of vaporization.

Isothermal horizontal infiltration experiments were conducted in 53-63 micrometer, 74-88 micrometer, or 105-125 micrometer glass bead fractions with water, 6% ethyl alcohol water solution, 20% ethyl alcohol water solution, ethyl alcohol, and methyl alcohol. From these experiments, the diffusivity coefficient was determined, and D (theta) was established for the fluid content, theta, from 0% to saturation. The D (theta) variation in the fluid content range between 3 and 30% was investigated. The functional relationships between D (theta) and the properties of the fluid, the geometry and the solid matrix were investigated. The physical components of D (theta) were determined using: D (theta) = ((r* sq/R* sq) x (sigma(cos alpha)/mu) - 0.00041 Delta H + 5) x 0.01 theta where r* and R* are the mean radius of pores and beads, respectively, sigma, micron, and Delta H sub v are the surface tension, viscosity and molar heat of vaporization of the fluid, respectively, and alpha is the fluid-solid contact angle. The physical significance of the diffusivity coefficient given by Laroussi and De Backer (1975) defining this coefficient as the ease with which the fluid particles spread from a wetting front, is clarified and confirmed. (See also W76-01851) (Visocky-ISWS)
W80-00754

2H. Lakes

PHYSIOLOGICAL ADAPTATIONS OF SALMONID FISHES (SALMO CLARKI HENSHAWI, SALMO GAIRDNERI, AND ONCORHYNCHUS KISUTCH) TO ALKALINE SALINE WATER AND THEIR TOXIC EFFECTS,
Nevada Univ. System, Reno. Desert Research Inst.
J. Knoll, D. L. Koch, R. Knoll, J. Sommer, and L. Hoffman.
Desert Research Institute Publication No. 50009, July 1979, 82 p, 15 fig, 10 tab, 60 ref. OWRT B-087-NEV(1), 14-31-0001-5136.

Descriptors: *Fish physiology, Adaptation, Alkaline water, Salmo clarki, Salmo gairdneri, Oncorhynchus kisutch, Trout.

Two studies were conducted to determine the physiological adaptations of 3 salmonid fishes to the alkaline, slightly saline waters of Pyramid Lake, NV, and their toxic effects. In the acclimation study, growth rates and blood parameters of fingerling Lahontan cutthroat trout and Eagle Lake rainbow trout were compared when maintained in alkaline well water (pH 9.1), in Pyramid Lake water (pH 9.1), and in a 50% mixture of these waters. In the 2nd study a more detailed analysis was made of the morphological changes in the blood cells and other hematological parameters in rainbow trout that had been exposed to Pyramid Lake water. Results of the acclimation study indicate that Lahontan cutthroat trout in the 0.5 to 6 g size range were considerably more successful when raised in the Pyramid Lake water than in either the mixed or well water. The morphology of the blood cells of coho salmon, Lahontan cutthroat trout and well water exposed rainbow trout was similar. The leucocyte morphology of rainbow trout exposed to Pyramid Lake water exhibited atypical forms after 7 days exposure with these forms persisting throughout the study. Leucocyte counts were significantly lower after 7 days in Pyramid Lake water exposed rainbow trout than in well water exposed fish. In differential leucocyte counts of the Pyramid Lake water exposed rainbows, lymphocytes significantly decreased and neutrophils significantly increased throughout the study. These atypical forms, decreased leucocyte counts and increased neutrophil percentages may indicate a sublethal stress condition. (Smith-Nevada)
W80-00488

COOLING IMPOUNDMENTS: CLASSIFICATION AND ANALYSIS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
G. H. Jirka, and D. R. F. Harleman.
Journal of the Energy Division, American Society of Civil Engineers, Vol. 105, No. EY2, Proceedings Paper 14779, p 291-309, August 1979. 8 fig, 3 tab, 17 ref, 1 append.

Descriptors: *Cooling water, *Impoundments, *Classification, *Analysis, Model studies, Mathematical models, Ponds, Lakes, Powerplants, Heat transfer, Stratification, Thermal stratification, Temperature, Flow, Circulation, Water circulation.

Cooling impoundments can have different degrees of internal temperature stratification and of internal flow circulations. Classification criteria were presented that predict the existence of these internal conditions based on the size and shape of the impoundment, the condenser flowrate, temperature rise, and the design of intake and discharge structures. A computer model for the prediction of transient temperature distributions in cooling impoundments was developed. Depending upon the hydrothermal condition, one of four model elements was applied: (1) natural reservoir model for computation of lightly loaded ponds or of natural baseline conditions; (2) a deep stratified cooling pond model for well stratified impoundments; (3) a shallow dispersive cooling pond model for well channelized, elongated pond shapes; and (4) a shallow recirculating cooling pond model for ponds with significant internal circulation patterns. Comparison with applicable field data showed good agreement with the predictive models. (Sims-ISWS)
W80-00580

WEAK AND STRONG ACIDS IN THE SURFACE WATERS OF THE TOVDAL REGION IN S. NORWAY,
Central Electricity Generating Board, Leatherhead (England). Research Lab.
For primary bibliographic entry see Field 2K.
W80-00624

SEASONAL CHANGES IN THE SPECTRAL COMPOSITION OF DOWNWELLING IRRADIANCE IN LAKE KINNERET (ISRAEL),

Bar-Ilan Univ., Ramat Gan (Israel). Dept. of Life Sciences.
Z. Dubinsky, and T. Berman.
Limnology and Oceanography, Vol. 24, No. 4, p 652-663, July 1979. 15 fig, 3 tab, 42 ref.

Descriptors: *Irradiation, *Lakes, *Seasonal, Solar radiation, Light, Light penetration, Euphotic zone, Chlorophyll, Zooplankton, Light quality, Wavelengths, Optical properties, Biology, Limnology, *Israel, *Lake Kinneret(Israel), Downwelling irradiance.

A submersible scanning radiometer was used to measure seasonal variations in the intensity and spectral characteristics of downwelling irradiance in Lake Kinneret, Israel. Extinction coefficients for photosynthetically active radiation (350-750 nm) varied from 0.2 to 3.3 ln units/m, and the euphotic zone (1% of light energy at surface) ranged from 1.7 to 11 m. Specific extinction coefficients of chlorophyll, k sub c (ln units/mg/sq m), and water, k sub w (ln units/m), were dependent on the wavelength at which they were measured (at 650 nm, k sub c = 0.011, k sub w = 0.693; for 350 to 750 nm, k sub c = 0.007, k sub w = 0.489). High concentrations of chlorophyll and other cell pigments during the annual Peridinium bloom strongly attenuated light penetrance and caused a spectral shift toward the red to give elevated quantum to joule (Q:W) ratios (2.96 x 10 to the 18th power). (Sims-ISWS)
W80-00629

IMPORTANCE OF LAKE-RIVER INTERACTION ON SEASONAL PATTERNS IN THE GENERAL CIRCULATION OF KAMLOOPS LAKE, BRITISH COLUMBIA,
Department of the Environment, Vancouver (British Columbia). Inland Water Directorate.
E. C. Carmack, C. B. J. Gray, C. H. Pharo, and R. J. Daley.
Limnology and Oceanography, Vol. 24, No. 4, p 634-644, July 1979. 11 fig, 21 ref.

Descriptors: *Lakes, *Canada, *Water circulation, *Rivers, Mixing, Temperature, Water temperature, Density, Turbidity, Circulation, Flow, Seasonal, On-site investigations, Heat budget, Limnology, *Thompson River(British Columbia), *British Columbia, *Kamloops Lake(British Columbia), Cabbeling.

The physical effects of a large river (Thompson River) entering a deep, intermontane lake (Kamloops Lake, British Columbia) suggest that, depending upon its temperature relative to that of lake water, river water moves through the lake as a surface overflow, an intermediate depth interflow, or a near-bottom underflow. Circulation is further influenced by the earth's rotation so that the incoming river flows preferentially along the right-hand shoreline of the lake. Convective overturn in autumn and spring is influenced by cabbeling, which occurs whenever two parcels of water, one warmer than 4 C and one colder, combine to form a mixture whose temperature is at or near 4 C. (Sims-ISWS)
W80-00631

NEW ASPECTS OF THE CONSIDERATION OF FEEDBACK MECHANISMS IN AN ECOLOGICAL MODEL OF THE PELAGIC ZONE,
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
J. Benndorf, D. Uhlmann, and F. Recknagel.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 170-184, 1978. 11 fig, 44 ref.

Descriptors: *Ecosystems, *Lakes, *Aquatic life, *Model studies, Productivity, Growth rates, Freshwater, Mixing, Phytoplankton, Biomass, Attenuation, Nutrients, Phosphates, Pelagic zone, Feedback mechanisms.

In order to achieve a more realistic model of the pelagic zone of lakes and reservoirs, three feedback mechanisms were investigated. (1) A 'mixing model' involves higher light utilization by the phytoplankton at intensive vertical mixing of the water body, a high light attenuation coefficient, and a low mixing depth. This combination of variables results in higher primary production rates compared with the conventional (static) model. As the high light attenuation coefficient is self-generated by the high phytoplankton biomass, this phenomenon can be taken as a positive feedback mechanism. (2) In connection with the vertical mixing in water with mass growths of phytoplankton, a further positive feedback loop plays an essential role: the self-regenerated carbon dioxide flux within the algal-bacterial association. (3) The negative feedback between the biomass and specific activity (e.g., rate of phytosynthesis per unit biomass) leads to a more sophisticated version of the Monod kinetics and enables the model to respond realistically to external disturbances. (See also W79-00379) (Humphreys-ISWS)
W80-00715

NUTRIENT EXCHANGE BETWEEN VOLUME ELEMENTS OF LARGE LAKES,
Canada Centre for Inland Waters, Burlington (Ontario).
T. J. Simons, and D. C. L. Lam.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 185-191, 1978. 4 fig, 7 ref.

Descriptors: *Water quality, *Lakes, *Model studies, *Great Lakes, *Lake Ontario, On-site investigations, Nutrients, Mathematical models, Analytical techniques, Ecosystems, Distribution, Movement, Mass transfer, Heat balance, Stratification, Phosphorus, Nitrogen, Carbon, Chlorophyll, Water circulation, Spatial distribution.

In recent years it has become possible to incorporate a complete description of three-dimensional mass exchanges in water quality models of large lakes. The present paper reviewed some experiments with water quality models of Lake Ontario which include hydrodynamic simulations of horizontal and vertical water transports. The effects of mass exchanges were illustrated by combining observed concentration gradients with computed water motions. Considered were vertical exchanges across the thermocline and horizontal transports between shore zones and open water. It was shown that the resulting internal nutrient loadings are far greater than direct external inputs. (See also W79-00379) (Humphreys-ISWS)
W80-00716

WATER QUALITY IN LENTIC WATER BODIES (LAKES AND RESERVOIRS),
Salford Univ. (England). Dept. of Civil Engineering.
B. Henderson-Sellers.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 192-199, 1978. 6 fig, 22 ref.

Descriptors: *Water quality, *Lakes, *Model studies, *Lentic environment, Reservoirs, Water temperature, Analytical techniques, Mathematical models, Dissolved oxygen, Hypolimnion, Stratification, Heat transfer, Freshwater, Diffusivity, Destratification, Spatial distribution.

A one-dimensional numerical model for prediction of vertical variations in temperature and water quality in a freshwater lake or reservoir was described. Vertical transfer is by wind-induced turbulent diffusion: several forms for the coefficient of eddy diffusivity for both heat and oxygen were discussed. Water quality was analyzed in terms of the dissolved oxygen content, for which a knowledge of respirative sinks and photosynthetic sources is necessary. The average, annual structure of a lake was predicted utilizing the long-term stability of such systems, and comparisons were made with data from a number of British lakes and reservoirs. It was apparent that the hypolimnetic water is often unsuitable for human consumption during periods of stratification. Measures to eliminate the thermocline or to enhance the oxygen levels in the hypolimnion were discussed, and a numerical model of 'jetting' was described and implemented. (See also W79-00379) (Humphreys-ISWS)
W80-00717

MODELLING OF THE EUTROPHICATION PROCESS IN LAKES AND RESERVOIRS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
M. Watanabe.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 200-210, 1978. 4 fig, 2 tab, 13 ref.

Descriptors: *Lakes, *Eutrophication, *Model studies, *Aquatic environment, Mathematical studies, Analytical techniques, Nitrogen, Phosphorus, Ecosystems, Water properties, Zooplankton, Phytoplankton, Water temperature, Dissolved oxygen, Biochemical oxygen demand, Biodegradation, Oxidation, On-site tests.

A closed, energy-driven, matter-flow loop of nitrogen-phosphorus cycles was proposed as a fundamental structure for understanding and controlling the eutrophication process in aquatic environments. It consists of 11 storage variables of nitrogen and phosphorus, and 14 transformations which represent observable biochemical reactions and ecological interaction. The mathematical model was applied to a microcosm experiment, and the comparison between predicted versus measured values supported the validity of the matter-flow rate mechanism of phosphorus and nitrogen cycles, although some modifications for modelling of phytoplankton and zooplankton are necessary. (See also W79-00379) (Humphreys-ISWS)
W80-00718

SOURCE SCHEMATIZATION EFFECTS ON FARFIELD RESULTS,
Envirosphere Co. Inc., New York.
A. P. Verma, and S. R. Gutti.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY8, Technical Notes, p 1026-1031, August 1979. 2 fig, 1 tab, 7 ref, 1 append.

Descriptors: *Mathematical models, *Water temperature, *Jets, *Spatial distribution, Dispersion, Analytical techniques, Model studies, Equations, Convection, Diffusion, Distribution patterns, Heated water, Outlets, Mixing, *Thermal plumes, Farfield zone.

Most mathematical models determine the temperature distribution associated with cooling water discharge from power plants by treating the affected region of receiving water bodies as nearfield and farfield zones. The nearfield zone is the part of the thermal field closest to the actual outfall, predominantly influenced by the configuration, momentum, and buoyancy of the discharge. The farfield represents the zone some distance away from the discharge and is characterized by the passive convection and diffusion mechanisms due to ambient flow regime. The present work examined the sensitivity of the farfield model results to three postulated source schematizations for a typical power plant discharge case. The following conclusions were from the results presented. For increasing distances from the source, the influence of source schematization on temperature distribution diminishes, as expected. The top hat distribution with uniform temperature equal to the maximum temperature (Case 2) approximates the Gaussian distribution (Case 1) more closely than does Case 3 with regard to prediction of temperature distribution. From a strictly engineering analysis point of view, the range of variation in the predicted values is tolerable and is of the same order of magnitude for the different source schemes. However, when one examines these numerical results, from a point of view of complying with thermal regulations or biological impact evaluation, these differences may be significant. (Humphreys-ISWS)

W80-00723

COMPARISON OF SELECTED CULTURAL, PHYSICAL, AND WATER-QUALITY CHARACTERISTICS OF LAKES IN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
G. C. Bortleson, and N. P. Dion.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 311, Price codes: A07 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 77-62, 1979. 54 p, 20 fig, 2 tab, 35 ref.

Descriptors: *Washington, *Lakes, *Limnology, *Chemical properties, *Physical properties, Lake basins, Water quality, Nutrients, Nitrification, Phosphorus, Dissolved oxygen, Eutrophication, Secchi disks, Measurement, Specific conductivity, Coliforms, Lake morphology, Lake morphometry.

The report presents comparisons and a graphical overview of the relative magnitude and regional and statewide distribution of 19 selected cultural, physical, and water-quality characteristics measured in a reconnaissance study of several hundred lakes in Washington. Statewide, mean depth of almost one-fourth of the lakes is shallow (2.0 meters or less), and only 7 percent of the lakes have mean depths greater than 20 meters. About one-third of the lakes had Secchi-disc readings of 2.0 meters or less, a value often considered characteristic of eutrophic lakes. The poorest water clarity was observed in the Columbia Plateau, where 68 percent of the lakes had Secchi-disc readings of less than 2.0 meters. More than one-third of the lakes in the State had total phosphorus concentrations that exceeded 30 micrograms per liter, a concentration that is often considered characteristic of eutrophic lakes. (Woodard-USGS)
W80-00766

2I. Water In Plants

RAINFALL INTERCEPTION BY EIGHT SMALL TREES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
A. R. Aston.
Journal of Hydrology, Vol. 42, No. 3/4, p 383-396, July 1979. 9 fig, 3 tab, 10 ref.

Descriptors: *Rainfall, *Interception, *Trees, Laboratory tests, Model studies, Mathematical models, Analytical techniques, Vegetation, Vegetation effects, Evaporation, Water storage, Leaves, Canopy, Rain, Throughfall.

Interception studies were undertaken on individual plants of selected tree species under a rainfall simulator. The results gave insight to the process of interception, provided information on the level of the interception storage of the test species, and illustrated the importance of leaf area. Two interception models were tested. The interception-drainage model gave unsatisfactory results. The modified exponential model proved adequate as long as the proportion of rainfall passing through the canopy could be estimated. This proportion was shown to be a function of leaf area index. The use of this model, together with a proposed simplified system, was discussed with the view of characterizing an ungaged plant community in which elaborate interception studies have not been undertaken. (Sims-ISWS)
W80-00744

EVAPORATION FROM VEGETATION IN LANDSCAPES DEVELOPING SECONDARY SALINITY USING THE VENTILATED-CHAMBER TECHNIQUE, I. COMPARATIVE TRANSPIRATION FROM JUVENILE EUCALYPTUS ABOVE SALINE GROUNDWATER SEEPS,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
E. A. N. Greenwood, and J. D. Beresford.
Journal of Hydrology, Vol. 42, No. 3/4, p 369-382, July 1979. 2 fig, 6 tab, 7 ref.

Descriptors: *Evapotranspiration, *Groundwater, *Water levels, *Trees, *Australia, On-site investigations, Transpiration, Evaporation, Measurement, Sampling, Salinity, Leaves, Forests, Agriculture, Vegetation effects, Biology, Eucalyptus trees.

Several Eucalyptus species were grown in plantations at three locations ranging in average annual rainfall from 420 to 850 mm. The main objective was to find for each site the species with the highest transpiration. At the latest sampling which was in summer about two years after germination, E. globulus showed the highest rate per tree (37 liter/day) immediately above a seepage area at the 850-mm site. At the 500-mm site, E. cladocalyx var. nana had the highest rate (30 liter/day), and at the 420-mm site, E. wandoo (26 liter/day) ranked first. Transpiration varied greatly among species. For those species common to all locations, transpiration declined with rainfall. Transpiration per unit leaf area also varied between species. At the 420-mm site, an increase in the average transpiration per unit leaf area, over all species, from 340 mg/sq cm/day in early summer to 1110 mg/sq cm/day in late summer suggested that the roots had reached a zone of higher water content. (Sims-ISWS)
W80-00755

2J. Erosion and Sedimentation

GEOMORPHIC STUDY OF UPPER MISSISSIPPI RIVER,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-00585

THE EFFECTS OF PH ON THE ALUMINUM, IRON AND CALCIUM PHOSPHATE FRACTIONS OF LAKE SEDIMENTS,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
R. Nur, and M. H. Bates.
Water Research, Vol. 13, No. 8, p 813-815, 1979. 2 fig, 1 tab, 4 ref.

Descriptors: *Hydrogen ion concentration, *Effects, *Oklahoma, *Lake sediments, *Phosphates, Aluminum, Iron, Calcium, Phosphorus, Phosphorus compounds, Sediments, Chemistry, Chemical analysis, Nutrients, Sampling, Analytical techniques, Sedimentology, *Lake Carl Blackwell(OK).

A laboratory study was conducted to determine the effect of sediment pH on the amount of phosphorus bound in the aluminum, iron, calcium, and saloid-bound fractions of sediments from Lake Carl Blackwell, Oklahoma. The pH of the lake sediment samples was experimentally altered by mixing them with distilled water with pH values ranging from 1 to 12. Once the pH of the sediment and overlying water had equilibrated, a one gram sample was fractionated using a modified Chang and Jackson procedure to determine the phosphorus bound in each fraction. The point of minimum fixation for this sediment was found to occur at a pH of 7.33. Aluminum and iron phosphate fractions were predominant in an acidic environment. There was more phosphorus found in the aluminum and iron fractions than in the calcium fraction, and the amount of saloid bound phosphorus was minimal at every pH investigated. (Sims-ISWS)
W80-00588

INFLUENCE OF SURFACE ROUGHNESS AND CLOD SIZE AND STABILITY ON SOIL AND WATER LOSSES,
Science and Education Administration, Lafayette, IN.
C. B. Johnson, J. V. Mannering, and W. C. Moldenhauer.
Soil Science Society of America Journal, Vol. 43, No. 4, p 772-777, July-August 1979. 6 fig, 5 tab, 11 ref.

Descriptors: *Soil surfaces, *Erosion, *Runoff, *Water loss, Soils, Soil properties, Stability, Farm management, Infiltration, Simulated rainfall, Soil compaction, Soil moisture, Moisture content, Soil science, Agriculture, Surface roughness, Clod size, Tillage, Plowing.

Rough cloddy surfaces increased infiltration and decreased soil erosion compared to smoother surfaces as determined by simulated rainfall studies. Overtilling reduced surface roughness and cloddiness. One field experiment showed that a rough surface decreased runoff by 77% and soil erosion by 89% of that from a smooth surface. Tillage of wet soil increased surface roughness, but another field experiment showed that clods resulting from plowing the soil when wet were quite unstable compared with clods from plowing nearer the upper plastic limit. Tilling of compacted soil results in greater cloddiness than tilling of uncompacted soils. However, a laboratory experiment showed that compacted loam clods were less resistant to breakdown by water drop energy than those from uncompacted soil. Compaction of silty clay loam and silty clay soils did not change their stability significantly. To be effective as an erosion control measure, soil clods must be large enough and stable enough to keep infiltration at a high level until the crop canopy covers the soil surface. These studies described the size and stability necessary to maintain a high level of runoff and erosion control. (Sims-ISWS)
W80-00593

MICROBIAL EFFECTS ON SOIL ERODIBILITY,
Iowa State Univ., Ames. Dept. of Agronomy.
R. R. Gasperi-Mago, and F. R. Troeh.
Soil Science Society of America Journal, Vol. 43, No. 4, p 765-768, July-August 1979. 6 tab, 19 ref.

Descriptors: *Soil erosion, *Microorganisms, *Effects, Laboratory tests, Simulated rainfall, Bacteria, Soil bacteria, Fungi, Soil fungi, Actinomycetes, Soils, Soil types, Permeability, Soil aggregates, Soil microorganisms, Erosion, Soil science, Microbial effects.

This study was undertaken to evaluate the effects of three microbial species on soil erodibility. Sterilized Ames (a Typic Albaqualf) and Nicollet (an Aquic Hapludoll) soils were inoculated with species of Pseudomonas, Streptomyces, and Penicillium. After 15 days of incubation, both treated and untreated soils were subjected to artificial rainfall to measure their erodibility. The Ames soil averaged 23% more runoff and 34% more sediment in the runoff than Nicollet, but 2.25 times as much Nicollet soil as Ames soil was caught on splashboards. Soil loss from sterile soil was more than from any other treatment, and that from the fungal treatment was the least. The unsterilized soil had runoff and erosion approximately equal to the average of the bacterial, actinomycetes, and fungal treatments used. The results showed that all of the microbial treatments used had significant positive effects on erosion resistance and that the Penicillium sp. had the strongest effect. (Sims-ISWS)
W80-00594

AN ANALYSIS OF THE PROCESSES OF RIVER BANK EROSION,
Victoria Univ. of Manchester (England). Geography Div.
J. M. Hooke.
Journal of Hydrology, Vol. 42, No. 1/2, p 39-62, June 1979. 5 fig, 6 tab, 24 ref.

Descriptors: *Bank erosion, *Rivers, *Erosion, *Europe, Statistical models, Hydrology, Antecedent moisture content, Model studies, Precipitation(Atmospheric), *Devon(England), *Erosion processes, Antecedent precipitation index.

Measurements of erosion were made on sections of river banks in Devon, England, over a period of 2.5 yr. Erosion pins were used and were found to be satisfactory. Data of the hydrological and meteorological conditions during each erosion period were collected; these were incorporated into a

stepwise multiple regression analysis of the conditions controlling the amount and distribution of river bank erosion. Field observations were shown to aid considerably in understanding the processes of removal of material. Two main methods of bank erosion were identified, corrosion and slumping, and these appeared to be associated with the influence of river flow levels and antecedent precipitation conditions, respectively. Antecedent precipitation index emerged as the variable providing highest explanation of the erosion characteristics, but the diversity of results from different sites illustrated the complex combinations of conditions related to erosion events. A tentative grouping of the sites according to the types and amounts of erosion and the variables explaining their distribution was suggested. (Lee-ISWS)
W80-00612

AN ASSESSMENT OF THE EFFECTS OF BATHYMETRIC CHANGES ASSOCIATED WITH SAND AND GRAVEL MINING ON TIDAL CIRCULATION IN THE LOWER BAY OF NEW YORK HARBOR,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
Wong Kuo-Chuin, and R. E. Wilson.
Special Report No. 18, Reference 79-1, January 1979. 28 p, 9 fig, 2 tab, 6 ref.

Descriptors: *Mining, *Tidal currents, *Circulation, *Environmental effects, New York, Sands, Gravels, Bathymetry, New York Harbor, Sea Grant program.

Present sand and gravel mining operations within the Lower Bay of New York Harbor are restricted to the east bank of Ambrose Channel and to the vicinity of Chapel Hill North Channel because of the concern that mining in other areas might adversely affect water quality and shore erosion. As part of an evaluation of environmental effects associated with expanded sand and gravel mining were simulated numerically tidal circulation patterns and tidal elevations in Lower Bay for a number of altered bathymetries corresponding to hypothetical mining operations. Results suggest that tidal currents will decelerate over the mined region and accelerate outside of them, and that the tidal stream will be deflected towards the region. It is also clear that the mining near the mouth of the Bay could increase tidal range along Staten Island substantially. (NOAA)
W80-00693

THE LOWER BAY COMPLEX,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
I. W. Duedall, H. B. O'Connors, R. E. Wilson, and J. H. Parker.
MESA New York Bight Atlas Monograph 29. New York State Sea Grant Program report No. NYSSGP-AM-79-002, May 1979. 46 p, 18 fig, 4 tab, 60 ref, 10 maps. Oversized pages.

Descriptors: *Water pollution sources, *Tidal currents, Estuaries, New York, Nutrients, Water properties, New York Bight, New York Harbor, Sea Grant Program.

The Lower Bay complex is the seaward part of New York Harbor and includes Raritan, Sandy Hook, and Lower bays. It connects with Upper Bay through a narrow constriction between Staten Island and Brooklyn. A dynamic and complex estuarine system, the bay complex receives a large, seasonally variable inflow of fresh water originating mainly from the Hudson River with lesser amounts from the Raritan and Passaic rivers. Sewage effluent is also a significant source of fresh water. Because of the variable inflow of fresh water, the distribution of water properties (salinity, nutrients, chlorophyll (1) also varies seasonally. Tides and tidal currents in the bay complex are semidiurnal; their patterns are complicated because of the shape of the bay, the variation in freshwater discharge, Coriolis acceleration, and the intricate connection of waterways. Tidal variations in water properties are large and can be perturbed significantly by storms. Sewage effluent from the New York metropolitan area is the principal source for the high concentrations of nutrients observed in the bay complex. A large fraction of these nutrients are consumed in biological processes occurring within the bay complex. (NOAA)
W80-00695

TEXTURAL PROPERTIES OF SURFICIAL SEDIMENTS OF LOWER BAY OF NEW YORK HARBOR,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
C. R. Jones, C. T. Fray, and J. R. Schubel.
Special Report No. 21, Reference 79-4, March 1979. 118 p, 9 fig, 7 tab, 2 ref, 3 append.

Descriptors: *Sediments, *Sediment distribution, *New York, Sands, Gravels, Mining, Statistical data, New York Harbor, Textural properties, Grain size.

The objective is to describe the textural properties of the surficial sediments of the Lower Bay of New York Harbor. The grain size distributions are summarized in tabular form. Figures summarize the spatial distributions of selected statistical parameters: median diameter, mean diameter, standard deviation, skewness, and kurtosis. A figure delimits 25 areas in the Lower Bay of New York Harbor on the basis of sediment texture. The textural properties of samples within each of these 25 areas are summarized in tables. (NOAA)
W80-00696

SEDIMENT YIELD AND LAND USE IN TROPICAL CATCHMENTS,
Washington Univ., Seattle. Dept. of Geological Sciences.
T. Dunne.
Journal of Hydrology, Vol. 42, No. 3/4, p 281-300, July 1979. 6 fig, 2 tab, 52 ref.

Descriptors: *Sediment yield, *Watersheds(Basins), *Tropical regions, *Land use, On-site investigations, Model studies, Mathematical models, Sediment transport, Topography, Drainage, Geology, Vegetation, Soils, Roads, Runoff, Erosion, Sediment sources.

Analysis of sediment yields from 61 Kenyan catchments allowed the refinement of regional relationships between the yields and their major controls. Land use, which has been ignored in earlier regional analyses, was the dominant control, but within each land-use category it was possible to recognize the effects of the climatic and topographic variables that other writers have stressed. The long-term geologic rate of erosion in these tropical environments was estimated to vary between 20 and 200 t/sq km/yr, depending mainly upon climate. These values agree closely with Douglas' estimate for undisturbed catchments. An analysis of the major sources of sediment in disturbed catchments suggested that rural roads contribute a large, and commonly ignored, fraction of the sediment leaving agricultural areas. The temporal pattern of sediment transport is also affected by land use, and emphasizes the significance of rare wet periods in the removal of soil from tropical catchments. (Sims-ISWS)
W80-00746

2K. Chemical Processes

THE EFFECTS OF PH ON THE ALUMINUM, IRON AND CALCIUM PHOSPHATE FRACTIONS OF LAKE SEDIMENTS,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
For primary bibliographic entry see Field 2J.
W80-00588

NATURE AND PROPERTIES OF WATER IN MONTMORILLONITE-WATER SYSTEMS,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W80-00597

DETAILED STRUCTURE OF PH IN HYDROMETEORS,
Maryland Univ., College Park.
D. E. Anderson, and H. E. Landsberg.
Environmental Science and Technology, Vol. 13, No. 8, p 992-994, August 1979. 2 fig, 4 tab, 17 ref. NSF ENV75-02 667-A03.

Descriptors: *Precipitation(Atmospheric), *Acidity, *Hydrogen ion concentration, *Maryland, Rain, Fog, Dew, Frost, Sampling, Chemical analysis, Trace elements, Sodium, Lead, Metals, Powerplants, Air pollution, Water pollution sources, On-site data collections, Analytical techniques, Vanadium, *Acid precipitation.

The pH values of various forms of atmospheric precipitation, dew, frost, fog were studied. Automatic precipitation collector-pH analyzers were developed for sampling of liquid and solid forms of precipitation. Data were collected under a wide variety of weather conditions at College Park, Maryland, near a major power plant, and from an area without nearby sources of pollution. Results from these three sites indicated that the precipitation pH, with a mean of 4.7, is not normally distributed when measured per millimeter of precipitation. In many events, a strong variation in pH was evident. In the course of the study, pH values ranged from 2.7 to 6.9 units. Sequential sampling upwind and downwind of a major power plant indicated that concentrations of nitrate, sulfur, trace metals (Na, Pb, V), and H(+) were higher downwind. Observations of dew and frost at three different sites indicated that the pH is normally distributed about 5.7 units. Values of fog water pH collected at Catoctin Mountain (near Camp David in northern Maryland) averaged 5.3 units. (Sims-ISWS)
W80-00616

WEAK AND STRONG ACIDS IN THE SURFACE WATERS OF THE TOVDAL REGION IN S. NORWAY,
Central Electricity Generating Board, Leatherhead (England). Research Lab.
G. M. Glover, and A. H. Webb.
Water Research, Vol 13, No 8, p 781-783, 1979. 2 fig, 9 ref.

Descriptors: *Acids, *Rivers, *Lakes, Sampling, Chemical analysis, Hydrogen ion concentration, Acidity, Chemicals, Humic acids, Fulvic acids, Surface waters, Precipitation(Atmospheric), Snow, Snow melt, Water chemistry, *Norway, Weak acids, Strong acids.

The concentrations of weak and strong acids in surface waters of the Tovdal region of southern Norway were measured during a spring snowmelt period. The determinations were made by the pH titration method due to Gran. The strong acid concentrations in Tovdal river water varied between 3 and 11 microequivalents/liter, while the weak acid concentrations were between 62 and 106 microequivalents/liter. The contribution of the weak acids to the hydrogen ion concentration ranged between 10 and 60%. The pH of the river water varied from 4.9 to 5.0; and in the absence of excess strong acid, the weak acids would have produced a pH of 5.2-5.3. The concentration of weak acids and their contribution to the hydrogen ion concentration were least during the period of most rapid thaw. No direct evidence of the nature of the weak acids was obtained, but routine chemical analysis data suggested that inorganic species derived from aluminum and silicon accounted for 40-60 microequivalents/liter, while 20-50 microequivalents/liter were attributable to humic and fulvic acids. The titration characteristics of the weak acids could be approximated closely by a polybasic acid with a first ionization constant in the range 0.000001 to 5 x 10 to the -7 power and less well defined weaker ionizations. Measurements on old snow containing coniferous tree litter and on melt water from a rocky barren contained weak acid concentrations comparable to the riverwater, indicating that only slight contact with vegetable matter on the ground is required to obtain significant concentrations of weak acids. (Sims-ISWS)
W80-00624

CHEMICAL ASPECTS OF A BRINE POOL AT THE EAST FLOWER GARDEN BANK, NORTHWESTERN GULF OF MEXICO,
Texas A and M Univ., College Station. Dept. of Oceanography.
J. M. Brooks, T. J. Bright, B. B. Bernard, and C. R. Schwab.
Limnology and Oceanography, Vol. 24, No. 4, p 735-745, July 1979. 5 fig, 5 tab, 28 ref. BLM AA 550-CT7-15, AA550-CT7-11, ONR N00014-75-C-0537.

Descriptors: *Water chemistry, *Gulf of Mexico, *Brines, Sampling, Chemical analysis, Salts, Sulfur, Hydrogen sulfide, Chemicals, Sea water, Fish, Plankton, Oceans, Oceanography, *East flower garden bank.

A small pool on the flank of the East Flower Garden bank at a depth of 72 m in the Gulf of Mexico contains anoxic, hypersaline (approximately 200 g/kg) water. The flux of brine into and out of the pool contributes to erosional processes on the bank. The bulk ionic composition of the brine is similar to that of the Orca Basin brine, but differences between the two in gaseous hydrocarbon and carbon isotope content indicate different modes of origin. High levels of bacterial activity in the brine are indicated by ATP (more than 80 ng/liter), hydrogen sulfide (more than 2,000 micromol/liter), isotopically light Sigma CO2 (delta 13C = -23 parts per thousand), and the apparent generation of elemental sulfur. (Sims-ISWS)
W80-00626

IMPACT OF IRRIGATION WATER SALINITY ON SOIL RUNOFF WATER AND GROUNDWATER IN MISSOURI,
Science and Education Administration, Columbia, MO. North Central Watershed Research Center.
For primary bibliographic entry see Field 3C.
W80-00635

SIMULATION MODEL OF THE EVOLUTION OF THE CHEMICAL COMPOSITION OF A MINERAL-SOLUTION SYSTEM AND ITS APPLICATIONS (MODELE DE SIMULATION DE L'EVOLUTION DE LA COMPOSITION CHIMIQUE D'UN SYSTEME MINERAUX-SOLUTION ET SES APPLICATIONS),
Groupement d'Etudes et de Realisations des Societes d'Amenagement Regional, Nimes (France).
For primary bibliographic entry see Field 5A.
W80-00721

2L. Estuaries

TILLAMOOK BAY ENTRANCE REFRACTION STUDY, TILLAMOOK, OREGON,
Army Engineer Waterway Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8A.
W80-00501

WATER QUALITY INVESTIGATION OF ESTUARIES OF GEORGIA, 1976,
Brunswick Junior Coll., GA.
Annual report prepared for Georgia Department of Natural Resources, Environmental Protection Division, January 1977. 61 p, 38 ref, 27 tab, 5 fig.

Descriptors: *Water quality, *Fouling, *Estuaries, *Georgia, *Estuarine environment, *Chemical properties, *Physical properties, Aquatic environment, Aquatic algae, Water pollution, Savannah River(GA), St. Mary's River(GA), Fouling organisms.

Results are presented of the 1976 water quality analysis of Georgia's estuaries. Eleven stations were established along the coast of Georgia from the Savannah River to the St. Mary's River; data were collected from January to December 1976. The monitoring program included making determinations of several physical and chemical parameters in the field, collection of several water samples which were shipped to the Environmental Protection Division's water quality laboratory facilities, and collection, enumeration and identification of organisms attached to fouling plates. There was a positive correlation between the conductivity of the water and chloride concentration, total alkalinity and total solids. All stations were in oxidizing environments, were within the normal range of pH values and had low concentrations of nitrogen and phosphorous compounds. Dissolved oxygen was moderately high at all stations but was at its lowest concentration and saturation during the warm months May-September. Average biological oxygen demand (BOD5) was low at most stations. There was a direct relationship between number of organisms collected at a station and total organic carbon of the waters. Hydroids, barnacles, ectoprocts and tube building amphipods are the dominant fouling plate organisms and they showed very definite seasonal abundance patterns. (Iervolino-NC)
W80-00553

PERFORMANCE ANALYSIS OF TETHERED FLOAT BREAKWATER,
Scripps Institution of Oceanography, La Jolla, CA.
For primary bibliographic entry see Field 8B.
W80-00587

SHELF SEA FRONTS' ADJUSTMENTS REVEALED BY SATELLITE IR IMAGERY,
University Coll. of North Wales, Menai Bridge. Marine Sciences Lab.
J. H. Simpson, and D. Bowers.
Nature, Vol. 280, No. 5724, p 648-651, August 23, 1979. 6 fig, 8 ref.

Descriptors: *Oceans, *Tides, *Ocean circulation, Remote sensing, Satellites(Artificial), Tidal waters, Circulation, Mixing, Infrared radiation, Temperature, Water temperature, Continental shelf, Oceanography, *Fronts(Oceanic), *Irish Sea.

IR imagery from NOAA 5 has been used to study the movement of shelf sea fronts. After the elimination of tidal advection, the fronts show remarkable consistency of position and do not adjust to the strong semi-monthly variation in tidal stirring which indicates the operation of a feedback process in vertical mixing. (Sims-ISWS)
W80-00603

ISOTOPIC COMPOSITION OF RIVER RUNOFF ON THE U.S. EAST COAST: EVALUATION OF STABLE ISOTOPE VERSUS SALINITY PLOTS FOR COASTAL WATER MASS IDENTIFICATION,
Woods Hole Oceanographic Institution, MA. Dept. of Chemistry.
T. Torgersen.
Journal of Geophysical Research, Vol. 84, No. C7, p 3773-3775, July 20, 1979. 1 fig, 2 tab, 13 ref. DOE E- 2185, NSF OCE76-81774.

Descriptors: *Isotope studies, *Rivers, *Atlantic Ocean, Runoff, Stable isotopes, Oxygen isotopes, Deuterium, Salinity, Sampling, Coasts, Oceans, Data processing, Oceanography.

Measurements of delta D and some delta 180 measurements were made on 36 rivers which drain the east coast of the United States. Streamflow data were used to estimate the mean isotopic composition of runoff entering the Gulf of Maine, the Mid-Atlantic Bight, and the South Atlantic Bight. Assuming binary mixing between central Atlantic water and these fresh runoff waters, coastal water in the Gulf of Maine was isotopically indistinguishable from runoff into the Mid-Atlantic Bight and runoff from the St. Lawrence at salinities greater than 32 parts per thousand. However, up to salinities of 34 parts per thousand the mean isotopic composition of runoff into the South Atlantic Bight was sufficiently different from the Mid-Atlantic Bight that the identification of coastal water masses in and around Cape Hatteras by delta D and/or delta 180 versus salinity plots should be possible. (Sims-ISWS)
W80-00607

ON THE GENERATION OF THE SEASONAL COASTAL UPWELLING IN THE GULF OF GUINEA,
Washington Univ., Seattle, Dept. of Oceanography.
A. J. Clarke.
Journal of Geophysical Research, Vol. 84, No. C7, p 3743-3751, July 20, 1979. 6 fig, 26 ref, 1 append. NSF IDO 7503998, DOE E76S062225TA25-7.

Descriptors: *Coasts, *Africa, *Atlantic Ocean, *Upwelling, *Model studies, Mathematical models, Internal waves, Waves(Water), Ocean waves, Measurement, On-site investigations, Water temperature, Water levels, Winds, Oceanography, *Gulf of Guinea.

Seasonal upwelling in the coastal waters of the Gulf of Guinea is unusual because classical coastal upwelling theory does not even qualitatively hold there; there is no significant relationship between the upwelling and the local longshore wind stress. In this paper an attempt was made to qualitatively explain the Gulf of Guinea seasonal upwelling using coastal trapped forced wave dynamics. Two independent sets of data were used to compare theory with observation. Both indicated that provided dissipation of the travelling wind-forced wave is taken into account, the theory agrees qualitatively with observation. The implication is that the upwelling is generated by coastal wind forcing several hundred kilometers east of the upwelling region. The Gulf of Guinea coastal upwelling therefore does not seem to be related to upwelling generated along the equator or to deep ocean basin forcing--it is not an 'anti El Nino', as has been postulated elsewhere. (Sims-ISWS)
W80-00608

CHEMICAL ASPECTS OF A BRINE POOL AT THE EAST FLOWER GARDEN BANK, NORTHWESTERN GULF OF MEXICO,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 2K.
W80-00626

DISTRIBUTION OF SUSPENDED BACTERIA IN NERITIC WATERS SOUTH OF LONG ISLAND DURING STRATIFIED CONDITIONS,
National Marine Fisheries Service, Beaufort, NC.
R. L. Ferguson, and A. V. Palumbo.
Limnology and Oceanography, Vol. 24, No. 4, p 697-705, July 1979. 6 fig, 3 tab, 32 ref. DOE AT(49-7)-5.

Descriptors: *Bacteria, *Marine bacteria, *Neritic, *Atlantic Ocean, Coasts, Continental shelf, Phytoplankton, Chlorophyll, Depth, Temperature, Water temperature, Sampling, On-site investigations, Data processing, Correlation analysis, Oceans, Biology, Marine biology, *New York Bight.

Bacteria (direct counts) averaged 1.85 million cells/ml in highly stratified waters south of Long Island during September 1976. The vertical distribution of bacteria was related to the location of the thermocline and the bottom, the horizontal distribution to distance from shore indicating longshore continuity. The average numbers of bacteria (million cells/ml) in neritic water were 2.14 nearshore, 1.96 midshelf, and 0.67 near the shelf break. Overall, the number of bacteria was positively correlated with chlorophyll and ammonium concentrations but not with measurements of heterotrophic activity. The location of a large, relatively inactive population of bacterial cells near the surface of the highly stratified midshelf water corresponded to the approximate location of unusually persistent phytoplankton blooms observed during March-June 1976. (Sims-ISWS)
W80-00627

THE PRODUCTION AND FATE OF PHYTOPLANKTON SIZE FRACTIONS IN THE PLUME OF THE HUDSON RIVER, NEW YORK BIGHT,
Lamont-Doherty Geological Observatory, Palisades, NY. Dept. of Marine Biology.

T. C. Malone, and M. B. Chervin.
Limnology and Oceanography, Vol. 24, No. 4, p 683-696, July 1979. 7 fig, 6 tab, 39 ref. NOAA 03-4-043-310, 04-5-022-22, 04-7-022-44003, DOE EY76-S-02-2185B.

Descriptors: *Phytoplankton, *Marine biology, *Estuaries, *Coasts, *Atlantic Ocean, Sampling, Data processing, Diatoms, Copepods, Biomass, Chlorophyll, Density, Water temperature, Salinity, Zooplankton, Nanoplankton, Carbon, Organic matter, Oceans, Oceanography, *New York Bight.

Seasonal effects fof water column stability phytoplankton growth, and copepod grazing on the biomass of phytoplankton size fractions were described in the context of variations in particulate organic carbon (POC). Net plankton biomass was more variable in time (between weeks and months), while nanoplankton biomass was more variable in space (between surface and bottom layers and between stations). Biomass was highest and most uniformly distributed during February-March when net plankton diatoms dominated and doubling times approximated the flushing time of the plume. Biomass declined rapidly with depth and distance from the mouth of the estuary during June-July when nanoplankton dominated and doubling times were short relative to the flushing time of the plume. Variations in POC were well correlated with phytoplankton biomass when net plankton dominated and biomass was limited by sinking and mixing. When nanoplankton dominated, biomass was limited mainly by grazing and correlations between POC and biomass were poor. It appears that most of the biomass produced by net plankton diatoms sinks from the surface layer before the summer thermocline develops, while most of the biomass produced by nanoplankton during the summer enters pelagic food chains before sinking from the surface layer. (Sims-ISWS)
W80-00628

ESTIMATES OF VERTICAL EDDY DIFFUSION THROUGH THE THERMOCLINE FROM PHYTOPLANKTON NITRATE UPTAKE RATES IN THE MIXED LAYER OF THE EASTERN TROPICAL PACIFIC,
Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, ME.
F. D. King, and A. H. Devol.
Limnology and Oceanography, Vol. 24, No. 4, p 645-651, July 1979. 3 fig, 4 tab, 20 ref. ONR N00014-76-0271, NSF DES75-21280, NSF GB-7294.

Descriptors: *Diffusion, *Mixing, *Nitrates, *Pacific Ocean, Nutrients, Salinity, Density, Water temperature, Oxygen, Dissolved oxygen, Phytoplankton, Thermocline, Oceans, Oceanography, Marine biology, Eddy diffusion.

Vertical eddy diffusion coefficients ranging from 0.05-1.1 sq cm/s were calculated from phytoplankton nitrate uptake rates in the mixed layer and nitrate gradients at the top of the thermocline of the eastern tropical North Pacific. An empirical relationship was determined between these diffusion coefficients and density gradients in the thermocline. This relationship was used to calculate nitrate fluxes through the thermocline at several stations where nitrate uptake was not measured, and the fluxes indicated that an average of 29% of the primary productivity was supported by the uptake of nitrate-nitrogen. (Sims-ISWS)
W80-00630

UPWELLING AND ESTUARY FLUSHING,
Washington Univ., Seattle. Dept. of Oceanography.
A. C. Duxbury.
Limnology and Oceanography, Vol. 24, No. 4, p 627-633, July 1979. 3 fig, 3 tab, 3 ref.

Descriptors: *Estuaries, *Upwelling, *Water circulation, *Washington, On-site investigations, Measurement, Sampling, Flow, Mixing, Salinity, Pollutants, Saline water-freshwater interfaces, Harbors, Coasts, Estuary flushing.

Salinity data collected during 1965-1969 in Grays Harbor, Washington, along with river discharge data, were used to determine the water and salt budgets of the inner harbor. The fluxes of water at the seaward end of the inner harbor, T sub o seaward at the surface and T sub i inward at depth, were calculated. T sub o was proportional to but larger than the river discharge throughout the year except for the months of August through October when T sub o was related to T sub i and T sub i was driven by the influx of dense water into the harbor caused by upwelling along the coast. Thus, the flushing rate of the inner harbor, as determined by its volume divided by T sub o, is much greater during late summer than previously suspected. The calculated rate of removal of material associated with the water in the inner harbor, based on a T sub o derived from river flow and the percentages of river and harbor water making up T sub o, is 19% per day, in agreement with a previous flushing study. (Sims-ISWS)
W80-00632

THE LOWER BAY COMPLEX,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 2J.
W80-00695

ON THE CHOICE OF BOUNDARY CONDITIONS FOR ONE-DIMENSIONAL MODELS OF ESTUARINE WATER QUALITY,
University Coll., Dublin (Ireland). Dept. of Civil Engineering.
J. P. O'Kane.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 77-85, 1978. 1 fig, 12 ref, 1 append.

Descriptors: *Water quality, *Estuaries, *Mathematical models, *Equations, Dispersion, Mathematical studies, Model studies, Convection, Diffusion, Spatial distribution, Theoretical analysis, Analytical techniques, Salinity, One-dimensional models, Mass balance.

The one-dimensional convective-diffusion equation was assumed to describe the dispersion of a contaminant in an estuary. Very general solutions were presented for Dirichlet (prescribed concentration) and zero Neumann (specified concentration gradient) boundary conditions. These correspond respectively to infinite and zero values of dispersion in the adjoining sea. The intermediate conditions were studied by matching at the mouth realistic dispersion models for both the sea and the estuary. This provides a basis for judging the validity of the Dirichlet condition which is almost always used. (See also W79-00379) (Humphreys-ISWS)
W80-00706

ADAPTATION OF THE EPAECO MODEL TO A LAKE IN CENTRAL FINLAND,
National Water Board of Finland, Helsinki.
K. A. I. Kinnunen, J. S. Niemi, and J. Eloranta.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 115-127, 1978. 8 fig, 1 tab, 12 ref.

Descriptors: *Model studies, *Lakes, *Ecosystems, *Water quality, Mathematical models, Aquatic environment, Discharge(Water), Phytoplankton, Biomass, Productivity, Dissolved oxygen, Water temperature, Alkalinity, Hydrogen ion concentration, Zooplankton, Dissolved solids, Phosphorus, Foreign research, *Finland, *Lake Paijanne(Finland), EPAECO model.

The one-dimensional, deterministic lake ecological simulation model EPAECO was applied to the uppermost sub-basin of Lake Paijanne, Central Finland. The model was calibrated with data from 1974 and verified with the corresponding data of 1975 and 1976. The agreement between simulated and observed values was evaluated simply by examining the graphical presentation of the results. Most of the state variables of the model could be verified, with the exception of phosphate phosphorus. Calculated values of the phytoplankton biomass were at the same level as the observed ones. Comparisons between simulated and observed values of some state variables, including zooplankton, detritus, benthic animals, total dissolved solids, and fish populations, could not be made because of insufficient observed data. It was concluded that more studies with different types of lakes should be carried out to obtain additional information on the suitability of the model as a management tool. (See also W79-00379) (Humphreys-ISWS)
W80-00710

A MATHEMATICAL ECOSYSTEM MODEL APPLICABLE TO SHALLOW WATER BODIES,
Deutsche Akademie der Wissenchaften zu Berlin (German D.R.). Inst. fuer Geographie and Geookologie.
G. Schellenberger, H-P. Kozerski, H. Behrendt, and S. Hoeg.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 128-136, 1978. 5 fig, 19 ref.

Descriptors: *Mathematical models, *Lakes, *Ecosystems, *Water quality, Model studies, Shallow water, Productivity, Detritus, Phytoplankton, Aquatic environment, Aquatic plants, Analytical techniques, Theoretical analysis, Phosphorus, Nitrogen, Algae.

In order to permit prediction and control of water quality, a general ecosystem model for shallow water basins was set up and tested against observed data from a chain of boddens (shallow inlets of the Baltic) and Lake Muggelsee. The model covers the energy flow through the system, the cycling of the nutrients phosphorus and nitrogen, and considers 17 components in an arbitrary number of horizontally arranged segments. Especial emphasis has been laid on the exchange of nutrients and particulate organic matter between sediment and water, on the significance of a resistant pool in the cycling of nutrients, and on a generalized formulation of all considered processes. The comparisons between observed data and computed simulations were relatively good. (See also W79-00379) (Humphreys-ISWS)
W80-00711

A SIMPLE EUTROPHICATION MODEL FOR THE BAY OF KESZTHELY, LAKE BALATON,
Research Inst. for Water Resources Development, Budapest (Hungary).
G. Jolankai, and A. Szollosi-Nagy.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 137-150, 1978. 5 fig, 16 ref.

Descriptors: *Mathematical models, *Lakes, *Eutrophication, *Water quality, Model studies, Analytical techniques, Theoretical analysis, Equations, Water chemistry, Hydrobiology, Hydrology, Phosphorus, Algae, Productivity, Biomass, Ecosystems, Algorithms, Foreign research, *Hungary, *Lake Balaton(Hungary).

Lake Balaton, and especially its Bay at Keszthely, is facing the danger of increasing eutrophication. Utilizing former plant nutrient discharge studies and records and also the records of lake hydrology, hydrobiology, and water chemistry, a simple algae-dissolved reactive phosphorus model was constructed to describe the eutrophication process. The model is mainly based on the specific condition that in Lake Balaton the main direct source of phosphorus is the uptake from the sediment with the indirect source being the input phosphorus load. The crucial point of modelling is the determination of the time varying (or rather varying as a function of meteorological factors) sediment phosphorus uptake coefficient. Consequently, a special parameter estimation technique was required. The dynamics of the model are nonlinear. On the other hand, the measurement equation is linear with a

white noise Gaussian measurement error sequence. To identify the unknown constants and the time varying parameters, the output error method was adopted. A recursive algorithm based on the maximum likelihood approach was developed for determining the unknown parameters and noise statistics. The algorithm utilizes the sensitivity matrix equation for the parameters. (See also W79-00379) (Humphreys-ISWS)
W80-00712

ENERGY EXCHANGE BETWEEN DEEP LAKES AND THE ATMOSPHERE AND THE CONSEQUENCES FOR THE WIND-MIXED LAYER DYNAMICS,
Haskoning, Nijmegen (Netherlands).
G. J. G. Kok.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 151-161, 1978. 4 fig, 8 tab, 17 ref.

Descriptors: *Lakes, *Boundary processes, *Mathematical models, *Water circulation, Air-water interfaces, Mixing, Ecosystems, Model studies, Deep water, Lake morphology, Heat transfer, Stratification, Interfaces, Energy transfer, Hypolimnion, Thermocline, Theoretical analysis, Equations, Analytical techniques, Wind velocity, Solar radiation, Epilimnion.

The exchange of heat and the input of wind energy through the water surface are essential mechanisms to explain the vertical distribution of turbulence and temperature in a deep lake with little throughflow. Depending upon the weather conditions and the lake's morphology, thermal stratification can appear, which separates the lake into a relatively warm turbulent surface layer, the epilimnion; and a relatively cold stagnant bottom layer, the hypolimnion. Both ecological sub-systems are divided by a movable interface, the thermocline. Following the wind-mixed layer theory from oceanography and applying the principle of heat conservation, the vertical distribution of temperature is computed as a function of time. Using daily mean weather data as forcing functions, the model is driven by the exchange of thermal and mechanical energies through the air-water and water-water interfaces. Anticipating pollution and eutrophication problems in deep lakes or reservoirs, modelling of the energy exchange at the water surface in relation to the wind-mixed layer dynamics gives a basic understanding of the physical limnology of the water body. (See also W79-00379) (Humphreys-ISWS)
W80-00713

HEAT AND MASS EXCHANGE COEFFICIENTS FOR OPEN WATER SURFACES,
Institute of Meteorology and Water Management, Warsaw (Poland).
For primary bibliographic entry see Field 2D.
W80-00714

SAND BED FRICTION FACTORS FOR OSCILLATORY FLOWS,
Coastal Engineering Research Center, Fort Belvoir, VA.
P. Vitale.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, WW3, Proceedings Paper 14754, p 229-245, August 1979. 8 fig, 1 tab, 17 ref.

Descriptors: *Beds, *Coastal engineering, *Energy dissipation, Ripple marks, Shear stress, Turbulence, Waves(Water), Hydraulics, Friction, *Bed forms, Coastal currents, Water tunnels, Wave attenuation, Oscillatory flows.

Published data from the Carstens, Neilsen, and Altinbilek oscillatory water tunnel tests were plotted as friction factor versus Reynolds number. These data, for three sand sizes and for both rippled and flat movable beds, were analyzed in a manner analogous to early treatment of flow in rough pipes that produced the Moody diagram. Laminar, transitional, and turbulent regimes were defined. The turbulent regime data were further analyzed to find the relative roughness, a combination of ripple height, grain size, and bottom particle displacement, which will predict the friction factor. The ripple heights for the 0.585 mm sand increased with increasing Reynolds number, while the ripple heights for the 0.297 mm and 0.190 mm sands decreased with increasing Reynolds number. Considering rippled beds only, the friction factor is proportional to the grain size divided by the square root of the Reynolds number. Grain roughness contributes 64% to 100% of the total bottom roughness, based on the relative roughness term. (Lee-ISWS)
W80-00734

ENERGETICS OF BREAKING WAVES WITHIN THE SURF ZONE,
Naval Postgraduate School, Monterey, CA. Dept. of Oceanography.
E. B. Thornton.
NR388-114.

Descriptors: *Waves(Water), *Ocean waves, *Coasts, *Beaches, Measurement, On-site investigations, Data processing, Turbulence, Energy, Velocity, Surf, Breaking waves.

Surface elevations and velocities were measured for a variety of breaking wave conditions including collapsing, plunging, and spilling breakers. Turbulent and wave-induced velocity components were separated by associating the wave-induced velocities with contribution coherent with the surface. Most of the measurements were made in the lower half of the water column and are indicative of conditions in this region. The average velocity intensity for all experiments was 85% wave induced, indicating that the kinetic energy is primarily wave induced. Remarkably little difference was found between collapsing, plunging, and spilling breakers in terms of percent wave-induced velocity intensity. Breaking waves can be characterized as highly nonlinear with strong wave-wave interactions resulting in energy being transferred away from the primary wave frequency, resulting in a saturation region at higher frequencies. Similarity arguments assuming kinematic instability with phase speed the only relevent parameter suggest a -3 slope for the log-log frequency spectrum of both the surface and horizontal velocities in shallow water. The surface elevation spectra of collapsing and plunging breakers have a slope more closely approximated by a -7/3 slope, indicating the possible importance of surface tension in the breaking processes; the velocity spectra show a -3 slope. The saturation region for spilling breakers surface elevation spectra varied from -3 at lower frequencies to -5 at highest frequencies. (Sims-ISWS)
W80-00737

SUMMERTIME SYNOPTIC VARIABILITY OF THE MIDDLE ATLANTIC SHELF WATER/SLOPE WATER FRONT,
Delaware Univ., Lewes. Marine Studies Complex.
C. N. K. Mooers, R. W. Garvine, and W. W. Martin.
Journal of Geophysical Research, Vol. 84, No. C8, p 4837-4854, August 20, 1979. 21 fig, 1 tab, 19 ref. ONR N00014-76-C-1051.

Descriptors: *Oceans, *New Jersey, *Delaware, *Maryland, *Continental shelf, *Atlantic Ocean, Continental slope, Circulation, Ocean circulation, Ocean currents, Currents(Water), Temperature, Water temperature, Salinity, Density, Thermocline, Sampling, Surveys, Data collections, Data processing, Oceanography, *Fronts(Oceanic).

A quasi-synoptic study of the shelf water/slope water front off New Jersey, Delaware, and Maryland in mid-July 1977 revealed an isolated body of very cold (less than 6 C) water in the near-bottom 'cold pool'. Its volume at least halved over 10 days during which nearby shelf waters were perturbed by two anticyclonic (warm core) eddies located over the continental slope. Water colder than 6 C lay along the bottom between the 80- and 100-m isobaths and was about 30 m thick. The seaward edge of the cold pool (here denoted as colder than 8 C) marked the inshore boundary of the shelf water/slope water subsurface temperature front, with 10 C variations per 2-20 km, depending upon alongshelf location. The thermocline underwent large displacements and deformations over 10 days, indicative of vigorous upwelling and downwelling and large potential vorticity changes at the shelf break. The dominant scales of variability (or correlation scales) in the thermal fields were 30 km alongshelf, 10 km cross shelf, and 10 to perhaps 20 days. (The internal radius of deformation on the outer shelf is about 15-25 km). There was substantial vertical structure on the scale of 10 m or less. A surface convergence zone coincided with a surface roughness band ('tide rip') near the shelf break, and internal gravity wave activity seemed intense there too. Two independent estimates of vertical velocity at the shelf break suggested values of about 0.01 cm/s, one for a time scale of a week or longer and the other for a time scale of at least a few hours. Over Wilmington Canyon a large 'lip' of cold pool intruded into the slope water along the southwestern side of the Canyon, perhaps undergoing entrainment and 'calving' by an anticyclonic eddy located over the slope. There was further evidence of offshore entrainment throughout the water column between the two eddies. (Sims-ISWS)
W80-00740

LOW-FREQUENCY SEA LEVEL AND CURRENT FLUCTUATIONS ALONG THE COAST OF NORTHWEST ITALY,
SACLANT ASW Research Centre, La Spezia (Italy).
A. J. Elliott.
Journal of Geophysical Research, Vol. 84, No. C7, p 3752-3760, July 20, 1979. 12 fig, 1 tab, 16 ref.

Descriptors: *Sea level, *Currents(Water), *Coasts, *Europe, Wind tides, Oceanography, Ocean waves, Oceans, Foreign countries, Foreign research, *Sea level fluctuation, *Italy, Current fluctuation, Coastal current, Cyclogenesis.

Two-month long records of current, sea level, and wind stress, collected during April and May of 1977, were analyzed for locations in the shallow waters off the coast of northwest Italy. The mean current was directed along the coast towards the northwest with a strength of 5-6 cm/s; this flow continued past the island of Elba, progressing from the Tyrrhenian Sea into the Ligurian Sea. Sea level fluctuations were coherent along the Ligurian coast of Italy and were mainly due to a wind-induced setup caused by the semi-enclosed nature of the basin; only a fraction of the sea level disturbances in the Tyrrhenian Sea propagated into the Ligurian basin. There was low coherence between the nearshore current and sea level, suggesting that shelf waves may play only a minor role in the dynamics of the region. Instead, the relation among the wind stress, current, and the slope of the sea level suggested that the region displays characteristics similar to those of a semi-enclosed area. The alongshore currents were coherent with the wind at the 5-day time scale; this agrees with the period of cyclone activity in the area and suggests that the shelf waters respond coherently when the wind field is spatially well organized during cyclogenesis. Consequently, an adequate hydrodynamic model of the region would need to couple both the atmospheric and the coastal responses. (Lee-ISWS)
W80-00742

LABORATORY SIMULATION OF THE GYRE IN THE ALBORAN SEA,
Woods Hole Oceanographic Institution, MA.
J. A. Whitehead, Jr., and A. R. Miller.
Journal of Geophysical Research, Vol. 84, No. C7, p 3733-3742, July 1979. 14 fig, 17 ref.

Descriptors: *Simulation analysis, *Stratified flow, *Hydraulic models, Density stratification, Laboratory tests, Buoyancy, Coriolis force, Hydraulics, Model studies, Channels, *Gyre, *Alboran Sea, *Strait of Gibralter.

A laboratory experiment was described which appears to exhibit flows which are similar to the flow-counterflow in the Strait of Gibraltar and, for certain values of the parameters involved, to the

gyre and front in the western Alboran Sea. The experiment was transient in nature and was made with two connecting basins on a rotating turntable. A sliding door was fitted into the channel connecting the two basins. Each basin was filled with water, the door was closed, and salt added to one side so that the two waters had different densities. After the waters spun up to rest in the rotating frame, the door was opened. A flow, driven by the density imbalance, was observed shortly thereafter, the lighter fluid rising up over the heavier fluid and pushing into the basin containing the heavy fluid. Likewise, the heavy fluid pushes into the basin containing lighter fluid. For very rapid rotation, these flows are violently unstable. For less rapid counterclockwise rotation, both currents stay confined to a narrow jet which clings to the right-hand wall of the basins which they are entering. At some lower rate of rotation, the jet cannot hold to a sufficiently curved wall, and the jet separates from the wall--a gyre was observed between the jet and the wall. The gyre and the jet initially are both a Rossby radius in size, but gradually the gyre grows larger. Growth of the gyre seems to result from an accumulation of fluid from the jet as it returns to the wall. Scaling arguments and estimates of buoyancy, Coriolis, and wind forces were advanced in support of the concept that this laboratory-produced gyre and the gyre in the Alboran Sea share the same dynamics. (Lee-ISWS)
W80-00743

EVALUATION OF A DIGITAL MODEL FOR ESTUARINE WATER QUALITY SIMULATION IN WASTE ALLOCATION STUDIES,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W80-00761

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

COST STRUCTURE IN DRINKING WATER SUPPLY AND THE PRICE STRUCTURES TO BE DERIVED FOR THEM,
Bochum (Germany, F.R.).
G. Schmidt.

Greatly increased water pollution and costs of uptake and purification in West Germany, coupled with drinking water demand which is doubling every 25-30 years, has shifted emphasis from variable costs dependent on output to fixed costs independent of output. Whereas in 1963 fixed costs accounted for 80% of total extraction costs, 81% of treatment costs, and 98% of distributioncosts, by 1974 these proportionshad risen to 88%, 84%, and 99%. Migration to suburbs has caused distribution problems and has also contributed to higher investment costs. Small-scale consumers and households have increased their share of total consumption from 55% in 1963 to 68% in 1975. A tariff system for water supply to such consumers should: (1) cover costs, (2) consider the enterprise's cost structure and the future movement of costs, (3) ensure adequate revenue, (4) help smooth load peaks for better capacity use, (5) limit wasteful water use, and (6) require only minimal enforecement costs regarding both monitoring and billing. According to an example given, the ratio of basic charge to unit price should approa40:60, customary in gas and electric supply. Basic charge should be figured on a variable basis determined by incurred. The problem of rising marginal costs on the input side can best be solved by periodically adjusting tstructure to the higher cost level rather than introducing complicated tariff systems dependent on assumed cons
W80-00485

3A. Saline Water Conversion

NON CONVENTIONAL WATER RESOURCES: SOME ADVANCES IN THEIR DEVELOPMENT,
Israel State Water Commission.
For primary bibliographic entry see Field 3C.
W80-00429

INCREASING AVAILABLE WATER SUPPLIES THROUGH WEATHER MODIFICATION AND DESALINATION,
Bureau of Reclamation, Washington, DC.
For primary bibliographic entry see Field 2B.
W80-00479

DEVELOPMENT OF A CHLORINE RESISTANT REVERSE OSMOSIS MEMBRANE AND POROUS MEMBRANE SUPPORTS,
Membrane Systems, Inc., San Diego, CA.
R. G. Sudak, M. E. McKee, R. L. Fox, and J. B. Bott.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-102973, Price codes: A05 in paper copy, A01 in microfiche. Final Report prepared for Office of Water Research and Technology, May 1979. 88 p, 14 fig, 16 tab. OWRT S-0125(8510)(1), 14-34-0001-8510(1).

Descriptors: Membrane systems, *Reverse osmosis, Thin-film membranes, Asymmetric membranes, Chlorine resistance, Polyamides, Polyepichlorohydrin, Polysulfone, Polyphenylsulfone, Polycarbonate, Polyimide, Polyvinylidenfluoride, Polyphenylquinoxaline.

A major drawback in the use of polyamide membranes in reverse osmosis has been the susceptibility of the polyamide membrane to chlorine attack. It had been hypothesized that elimination of the secondary amines in the membrane barrier layer would provide chlorine resistance to polyamide type membranes. Accordingly, polyepichlorohydrin (secondary diamines) was synthesized and interfacially reacted with isophtaloyl chloride to form membrane layers. Although the secondary amine was eliminated, the expected chlorine resistance was not obtained. Limited data indicate that chlorine resistance was obtained with an asymmetric polyimide membrane. To date, composite membranes have almost exclusively used polysulfone as a porous support material. The following additional membrane supports were developed: polycarbonate, polyphenylsulfone, polyimide, polyvinylideneflluoride, and polyphenylquinoxaline. The development of these porous membrane supports is outlined. (Easton-OWRT)
W80-00487

3B. Water Yield Improvement

NON CONVENTIONAL WATER RESOURCES: SOME ADVANCES IN THEIR DEVELOPMENT,
Israel State Water Commission.
For primary bibliographic entry see Field 3C.
W80-00429

WATER RESOURCES DEVELOPMENT, AND MANAGEMENT PLANNING IN ARID ZONES: CASE HISTORY-ISRAEL,
Tahal Consulting Engineers (Israel).
For primary bibliographic entry see Field 6A.
W80-00457

3C. Use Of Water Of Impaired Quality

NON CONVENTIONAL WATER RESOURCES: SOME ADVANCES IN THEIR DEVELOPMENT,
Israel State Water Commission.
M. Kantor.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 3, p 1017-1040.

Descriptors: *Water resources development, *Water reuse, *Desalination, *Cloud setting, *Evaporation control, *Water supply development, Waste water reclamation, Water resources, Water demand, Israel, Waste water treatment, Distillation, Solar distillation, Reverse osmosis, Flash distillation, Electrodialysis.

Increasing water demand has led to utilization of unconventional sources of water, such as cloud seeding, evaporation suppression, phreatophyte removal, glacier tapping, desalination, wastewater reclamation, long-distance water hauling, and transport of icebergs. This paper evaluates progress in developing: (1) desalination, (2) waste-water renovation, (3) artificial rainfall stimulation (cloud seeding), and (4) evaporation reduction. At present, development of all four depends on techniques which are either not yet economically justifiable (desalination, sewage reclamation), or not yet feasible according to engineering criteria (cloud seeding, evaporation reduction). Six desalination processes are evaluated: (1) multistage flash distillation, (2) multi-effect distillation, (3) vapor compression, (4) reverse osmosis, (5) solar distillation, and (6) electrodialysis. Product water cost is approximately proportional to the optimal specific energy cost per unit water production. Choice of process depends on capacity and reliability required, salinity of feed water, skilled personnel available, fuel demand, and specific investment per unit capacity. Water reclamation and reuse is presently the most economical solution to water shortages and presents no insurmountable technical problems, but precautions are necessary to protect community well-being. Most cloud seeding experiments have not been in a controlled environment and evaluations have been inconclusive. Evaporation suppression, even with further improvements, is not likely to become economically justifiable. (Lynch-Wisconsin)
W80-00429

ON WATER REUSE PROMOTION MEASURES,
Ministry of International Trade and Industry, Tokyo (Japan).
For primary bibliographic entry see Field 6F.
W80-00477

MICROBIOLOGICAL WATER QUALITY IN RELATION TO PUBLIC HEALTH,
Department of Health, Pretoria (South Africa).
L. S. Smith, and G. I. Van Rooyen.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2547-2559.

Descriptors: *Microbiology, *Water reuse, *Water quality standards, *South Africa, *Public health, *Sewage treatment, Water purification, Water sources, Water supply development, Effluents, Advanced treatment, Tertiary treatment, Microorganism, Bacteria, Coliforms, E. coli, Recycling, Self-purification.

Wastewater reclamation is a practical solution to water scarcity under most conditions provided adequate precautions are taken to safeguard public health. Simple standards are necessary to measure the exposure risk to waters of different quality. This paper reports standards issued by the Department of Health of South Africa in 1967 (and later revised), along with a critique by experts and some results of microbiological studies. In South Africa about 32% of purified sewage effluent is reused, 16% for crops, and parks, 9% for cooling, and 7% for industry. It is noted that stringent standards should not be applied to situations requiring less-demanding standards. Bacteria in hospital effluents may be important in the spread of bacterial R+ factors. Antiviral chlorination can only be achieved in water virtually freed of organic matter; crude sewage effluent can be brought to the highest quality by advanced treatment; water can be assumed free of microbial disease if it conforms to a bacterial plate count of 100 ml, and has no coliforms of E. coli per 100 ml and no viruses per 10 liters. Self-purification in water bodies is not reliable for reducing pathogens to safe levels for direct use. Critics of the standards agreed that vegetables to be eaten raw should not be irrigated with effluents of lower grade than advanced purifi-

cation, but some doubted any vegetables should be irrigated with waters of coliform levels of 100 E. coli/100 ml. (Lynch-Wisconsin)
W80-00482

INTEGRATION OF THERMAL AND FOOD PROCESSING RESIDUALS INTO A SYSTEM FOR COMMERCIAL CULTURE OF FRESH-WATER SHRIMP. (POWER PLANT WASTE HEAT UTILIZATION IN AQUACULTURE)., VOLUME II,
Public Service Electric and Gas Co., Newark, NJ. Research and Development Dept.
A. F. Eble.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 185, Price codes: A08 in paper copy, A01 in microfiche. Final Report, January 1977. 161 p, 11 ref, 29 tab, 13 fig, 8 append. AEN 74140-79 AOL and GI-43925.

Descriptors: *Electric powerplants, *Aquiculture, *Shrimp, *Trout, *Heated water, Fish, Foods, Effluents, Food processing industry, Trenton(NJ), New Jersey, Fish farming, Electric power industry, Electric power, Eels.

American eel (Anguilla rostrata), rainbow trout (Salmo gairdneri), and all life-cycle stages of tropical freshwater prawns (Macrobrachium rosenbergii) can be cultured successfully using waste-heat effluents of the Mercer electric generating plant at Trenton, N.J. Experiments in indoor heated nurseries and outdoor ponds and raceways continued July 1974 to October 1976. Eels stocked at 25 cm and 40 g in early July double their weight in four months. High-density prawn cultures up to 16 animals sq m are possible in outdoor ponds and raceways plus draped netting. Larvae are grown indoors in December and six cm juveniles can be transferred outdoors in May and harvested as 11-12 cm adults in October. Outdoor prawns grow an average of 1.3 cm mo and 3.7 g mo. Six months of intensive, high-density prawn cultures utilizing power plant heated effluent in temperature climates yield the equivalent of 12 months extensive culture in the tropics. Rainbow trout growth averages 10-12 g wk (November-May) with most growth (17 g wk) in spring (April-May). Intensive annual two-crop production can be maintained: postlarval prawns are grown indoors in spring, placed in outdoor ponds in mid-May, and harvested in October. Eighteen cm rainbow trout are stocked in raceways in early November and harvested as young adults (28 cm, 260 g) in early May. Aquaculture pumps close during chlorine cleaning procedures for the generating station. (Danovich-Wisconsin)
W80-00497

IMPACT OF IRRIGATION WATER SALINITY ON SOIL RUNOFF WATER AND GROUND-WATER IN MISSOURI,
Science and Education Administration, Columbia, MO. North Central Watershed Research Center.
R. W. Blanchar, and C. J. Palmer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-104839, Price codes: A07 in paper copy, A01 in microciche. Missouri Water Resources Research Center, University of Missouri, Completion Report, October 1979. 131 p, 30 fig, 25 tab, 79 ref, append. OWRT B-129-MO(2), 14-34-0001-9079.

Descriptors: *Soil water, *Salinity, Sodium, Salts, Hydraulic conductivity, Soil structure, Leaching, *Irrigation water.

The effect of different sodium absorption ratios (SAR) and salt concentrations on the saturated hydraulic conductivities for 18 soils ranging in base saturation from 26 to 94% was studied. Soils varied in their response to the salinity treatments and were classified as having either high, medium, low or no response. The soils most sensitive to changes in sodium and salt concentration had the lowest initial hydraulic conductivities and the highest clay contents. The soils which showed no response to the salinity treatments were very acid (pH 3.7-4.3). The relationship between the exchangeable sodium ratio (ESR) and the SAR of the final leachate was estimated and was almost identical to that given by the U.S. Salinity Laboratory staff (1954). The alternating current measurement of conductivity of electrolytic solutions are frequency (f) dependent due to electrode-electrolyte interactions which add a resistance known as the Warburg impedance to the true resistance. The true resistance is a function of the salt concentration and the mobility of ions in the soil. The two-component model of electrical conductance provides a method to evaluate the ionic diffusion coefficient from electrical conductance. A comparison of these results with the self-diffusion of 42K and 24NA shows that in most cases the two methods agree and provide useful estimates of the diffusion coefficients of these cations in soil.
W80-00635

EFFECTS OF ACID MINE DRAINAGE ON A SOUTHWESTERN PENNSYLVANIA STREAM,
California State Coll., PA. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-00684

3D. Conservation In Domestic and Municipal Use

LARGE ARRAY OF WATER CONSERVATION STRATEGIES FOR PIMA COUNTY, ARIZONA,
Army Corps of Engineers, Los Angeles, CA.
Pima Association of Governments 208 Project, Element 6, Tasks 6350 and 6360, Conservation Strategies and Program Development, May 1978, 75 p, 6 fig, 11 tab, 33 ref.

Descriptors: *Water management(Applied), *Water yield improvement, *Water conservation, *Alternate planning, *Comprehensive planning, Water resources development, Water supply, Hydrologic budget, Water utilization, Regional analysis, Water loss, Drainage area, Waste water disposal, Water allocation(Policy), Conjunctive use, Environmental effects, Pima County, Arizona.

In response to Task Report 6330 conclusions that water use and budget calculations in Pima County, Arizona indicate current water consumption by all users to be three times the dependable supply, the purpose of the present analysis is to identify and discuss a wide range of possible methods to reduce the amount of water lost from the overall water systems in Pima County. Accordingly, the water resource system of the region encompassing the Ajo, Avra and Altar, Upper and Lower Santa Cruz and Upper and Lower San Pedro areas is described through the identification of each of the components from supply, through use, to disposal in an attempt to illustrate how water is lost or consumed and what types of conservation programs are applicable. The impacts of certain conservation programs are identified and discussed where appropriate. (Tickes-Arizona)
W80-00648

3F. Conservation In Agriculture

WATER, FOOD, AND FIBER,
Soil Conservation Service, Washington, DC.
S. G. Boone.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2001-2012.

Descriptors: *Water management(Applied), *Fibers(Plant), *Agriculture, *Farm management, *Crop production, *Water resources development, Aquiculture, Foods, Irrigation, Drainage, Water utilization, Water supply, Land use, Pastures, Consumptive use, Rainfall.

Agriculture is the major consumer of water as well as the major land use in many nations, and as a result critical land and water resource problems are associated with programs which increase agricultural production. The world must double food production in the next 25-30 years; production of food and fiber requires great amounts of water. About 90% of human food comes from cultivated crops, principally cereals, which occupy some 10% of the earth's land area; grazing and pasture land occupy about 20%. Food and fiber production consume more water than other human uses, about 80% of all consumption. Over 60% of rainfall on the land surface is used by vegetation or evaporates directly into the atmosphere, while 65%-95% of water indomestic or industrial use returns to streams or underground reservoirs. World food production can be increased and water supplies conserved through water resources development measures, including: (1) more efficient use of available water by improved irrigation management, drainage, soil management, and fertilization; (2) improved production in rain-fed areas; (3) development of additional land which does not require large amounts of supplemental water; (4) developing new irrigated areas where water supplies and arable land exist; (5) aquaculture; (6) bettermanagement and use of ocean, lakes, and grazing land food resources; and (7) increasing productivity per unit resource input with improved technology. (Lynch-Wisconsin)
W80-00455

IRRIGATION MANAGEMENT IN DEVELOPING COUNTRIES: A SUGGESTED ACTION PROGRAMME,
Overseas Development Inst., London (England).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2539-2546.

Descriptors: *Developing countries, *Irrigation operation and maintenance, *Water management(Applied), *Water distribution, *Crop production, *Agriculture, *Planning, Irrigation, Agricultural extension, Training, Political constraints, Legal aspects, Priorities, Equity.

Recommendations of a workshop on Choices in Irrigation Management, organized by the Overseas Development Institute and held at Canterbury, United Kingdom September-October 1976, are presented. To achieve production and equity objectives through irrigation the major priority is not to construct new projects but to improve the operation and management of existing systems; this will increase domestic food supplies, conserve foreign exchange now spent on food imports, and improve income and security of a larger number of farmers. A seven-point program is recommended: (1) Evaluate current performance of irrigation and agriculture, considering political, organizational, and management factors, and farmer problems and incentives. (2) Reform irrigation staff management, with measures to improve prestige, morale, and performance, provision of adequate resources for operation and maintenance, and possibly creation of special technical cadres to coordinate water supply and planning and to provide advice. (3) Provide political and legal support of unpopular measures, such as redistributing among farmers. (4) Provide a strong agricultural extension service and water use training to farmers. (5) Create small irrigation groups within large irrigation schemes. (6) Intensify cropping and water use and expand the irrigated area. (7) Accord high political priority to improving irrigation operation and maintenance. (Lynch-Wisconsin)
W80-00481

CONSERVATION BENCH TERRACES FOR RICE IN A SUBHUMID CLIMATE,
Central Soil and Water Conservation Research Inst., Agra (India).
L. S. Bhushan.
Soil Science Society of America Journal, Vol. 43, No. 4, p 754-758, July-August 1979. 4 fig, 4 tab, 16 ref.

Descriptors: *Terracing, *Farm management, *Rice, *Subhumid climates, On-site investigations, Crops, Rainfall, Runoff, Water conservation, Water harvesting, Rain water, Agriculture, *India, Rain-fed farming, Conservation bench terraces.

Rain-fed crops in northern India produce less than the potential maximum due to moisture stress at

crucial stages of plant development. Research was initiated on a conservation bench terrace (CBT) system to evaluate its potential to increase water supply for increasing and stabilizing rice production on 2.5% sloping land in the subhumid climate. The width ratios of the contributing area to the collection area (terrace benches) were 0:1, 2:1, and 3:1. The contributing area was cropped with corn planted on the contour. Six years of research have shown that levelled benches received 0.25, 0.50, and 0.76 cu m/sq m of estimated runoff from the 1:1, 2:1, and 3:1 ratios, respectively. Consequently, measured soil water in the level benches was greater than the storage in level benches without a contributing area at the time of panicle emergence. The rice yields in the level benches with contributing areas were 21, 47, and 88%, respectively, greater on three ratios than yields on the level check without a contributing area. The 84% increase in rice grain yield on the 3:1 CBT was attributed to increased soil water content at panicle emergence. A major advantage of the CBT system was that chances of crop failure were reduced. The probability of obtaining rice yields of less than 1,400 kg/ha was decreased from 50% on level bench to 16% in level benches with a 3:1 ratio. Similarly, the probability of achieving yields greater than 3,500 kg/ha was 50% in the 3:1 CBT system and 0% in the level bench (NW). Total dry matter production for the 3:1 CBT system was 1.7 times greater than the level check. (Sims-ISWS)
W80-00595

IRRIGATION TECHNOLOGY FOR DESERT LAND RECLAMATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
E. V. Richardson, and V. A. Koelzer.
Advances in Desert and Arid Land Technology and Development, v. 1, Adli Bishay and Wm. G. McGinnies, eds. Harwood Academic Publishers, 1979, p 219-229.

Descriptors: *Irrigation systems, *Irrigation practices, *Irrigation efficiency, *Irrigation operation and maintenance, *Water management(Applied), *Cost benefit analysis, Sprinkler irrigation, Drip irrigation, Bubble irrigation, Surface irrigation, Land reclamation, Economic feasibility.

Successful irrigation of desert lands requires good water management which is difficult to obtain with surface irrigation systems. Sprinkler, drip, and bubble systems which often provide a more effective method of water management on desert arid soils are described and discussed here both in detail and in terms of some of the general advantages of the three systems in contrast to surface irrigation techniques. Based on the experiences and investigations of these authors in developing new croplands in Nebraska and Colorado, the following general conclusions are drawn: (1) center pivot irrigation systems provide an excellent method of obtaining good water management and large crop yields at relatively low overall costs for field crops such as beans, corn, sugar beet and cotton. The system is particularly well suited for rough ground and is a good method for soil types from sand to light soil. (2) Low head, closed conduit bubble systems have the advantages of low cost, simplicity of operation, low energy requirements and water savings when used on fruit trees and some vegetables. Although relatively uniform surfaces are required it can be engineered for fairly steep slopes devoid of large adverse breaks in grade. (3) On rough land where energy may not be a problem, trickle or drip techniques may be a good alternative to the bubble. (Tickes-Arizona)
W80-00641

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

ISOTOPE HYDROLOGY.
International Atomic Energy Agency, Vienna (Austria).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 857-864.

Descriptors: *Stable isotopes, *Radioisotopes, *Hydrology, *Environmental isotope techniques, *Tracers, *Groundwater, *Surface waters, Arid lands, Tritiu, Deuterium, Carbon radioisotopes, Oxygen, Instrumentation, Aquifers, Groundwater recharge, Groundwater movement, Lakes, Reservoirs, Sediment transport, Discharge(Water), Measurement, Methodology, Rivers, Estuaries, Mapping.

Stable and radioactive isotopes can be used to provide qualitative and quantitative information on flow and circulation of water within the hydrological cycle, usually through tracers. Techniques include environmental isotopes and artificial radioisotope and instrumental methods. The latter are usually applied to localized problems, while environmental isotope techniques, dependent upon natural labelling of water, are often used over large areas. This paper concentrates on environmental isotope methodology. Nuclear techniques are useful for both groundwater and surface water problems. Groundwater applications include source and area of recharge, flow velocity, time since recharge, leakage between aquifers, interchange between surface and groundwater systems, estimation of aquifer parameters, and groundwater inventory (especially valuable in arid regions). Surface water applications include discharge measurement, dynamics of lakes and reservoirs, leakage from hydraulic control structures, and sediment transport processes and rates in rivers and estuaries. The four most commonly used environmental isotopes are the stable isotopes deuterium and oxygen-18, and radioisotopes tritium and carbon-14. The first three, part of the water molecule, are the only real water tracers available; all others are present in a dissolved form and are subject to loss by precipitation, absorption, and exchange. Only three isotopic water species are of practical importance, H2 (16)0, HD(16)0, and H2(18)0. Case studies illustrate isotope hydrology. (Lynch-Wisconsin)
W80-00421

WATER FOR AGRICULTURE.
Food and Agriculture Organization of the United Nations, Rome (Italy).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 3, p 907-942.

Descriptors: *Agriculture, *Water supply development, *World Food Conference, *Irrigation, *Crop production, *Water resources development, Aquiculture, Fish farming, Data collections, Financing, Training, Near East, Latin America, Africa, Asia, Water management(Applied), United Nations, Rural areas, Soil management, Soil moisture, Developing countries.

The U.N. World Food Conference convened in 1974 in the midst of an acute weather-related global food crisis revealed deep-seated problems, and indicated urgent need for expanding food production in developing countries. A crucial factor was the difference in annual growth rate in food demand between developed countries (2.5%) and developing countries (3.5%), due mainly to faster population growth in the latter. The number of hungry people, 460 million in 1974, increased by 24 million by 1975, and is expected to increase by 12 million annually thereafter. Agricultural production can be increased by expanding the cultivated area, or by increasing yields per unit land through such inputs as fertilizers, improved crop varieties, plant protection, and mechanization; in many countries yield increase is the only alternative, and requires an adequate and timely water supply for success. Agricultural water development needs of Latin America, the Near East, Africa, and Asia are examined in regard to: (1) irrigation and drainage, (2) human resources and skills, (3) water supplies for rural settlement, and (4) aquaculture. Recommendations: (1) improve and expand irrigation systems, (2) improve soil moisture management, (3) protect land against flooding and waterlogging, and (4) introduce or expand fish rearing operations. Other important concerns are financing, advisory services, training, and education, planning, and institutional improvements. (Lynch-Wisconsin)
W80-00424

ENVIRONMENTAL ISSUES IN RIVER BASIN DEVELOPMENT,
United Nations Environment Program, Geneva (Switzerland).
For primary bibliographic entry see Field 2A.
W80-00433

RATIONAL METHODS OF FLOOD CONTROL PLANNING IN RIVER BASIN DEVELOPMENT,
Economic Commission for Europe (UN), Geneva (Switzerland).
For primary bibliographic entry see Field 6A.
W80-00435

METHODS FOR ESTIMATING GROUND WATER RESOURCES AND THE BALANCE OF SUBSURFACE WATERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 6B.
W80-00440

COMPUTERIZED OPTIMIZATION OF WATER RELEASES FROM RESERVOIRS,
Austrian Electrical Industries, Inc.
K. Fessl, A. Kalliauer, and G. Schiller.
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1755-1770.

Descriptors: *Austria, *Computer models, *Reservoir releases, *Mathematical models, *Hydroelectric power, *Water management(Applied), Reservoirs, Water supply, Water demand, Dynamic programming, Multiple-purpose reservoirs, Reservoirs, Model studies, Irrigation.

A mathematical model for use in reservoir management in Austria (specifically for reservoir releases) is designed as abstractly as possible for application to all conceivable management problems and is suitable for a nonlinear optimization method. In Austria all large reservoirs have been constructed for hydroelectric power generation, though they have also been used for flood control, flow improvement during low discharge periods, and tourism. The method described is also applicable to other uses of reservoir releases, such as irrigation or water supply. The computerized system has been used successfully with the Austrian reservoirs to adjust power generation to seasonal demand and production, coordinate production of the various power stations, and maintain high water levels for recreation. The storage system is visualized as a network in which reservoirs are nodes and flow control elements are branches. Nodes and branches are numbered, and an incidence matrix is used to express a relationship within the network. Pumping is considered negative flow. The optimization problem in the discharge variables involves linear constraints and a nonlinear objective function. An example is given of the Malta group of power stations in southern Austria, a large storage scheme incorporating seven hydro or pumping stations and six reservoirs. An extract from computer output is appended. (Lynch-Wisconsin)
W80-00445

THE ENVIRONMENTAL IMPACTS OF THE ASWAN HIGH DAM,
Academy of Scientific Research and Technology, Cairo (Egypt).
For primary bibliographic entry see Field 5C.
W80-00446

THE PROJECTS FOR THE INCREASE OF THE NILE YIELD WITH SPECIAL REFERENCE TO JONGLEI PROJECT,

Nile Waters Dept., Khartoum (Sudan).
K. A. Mohamed.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1799-1830.

Descriptors: *Nile River, *Sudan, *Water conservation, *Hydraulic engineering, *Irrigation, *Water resources development, *Planning, Water supply development, Rivers, Egypt, Economics, Jonglei Canal Project(Sudan), Canals, Diversion structures, Machar marshes(Sudan), Sobat Basin(Sudan), Behr El Ghazal Basin(Sudan), Embankments, Swamps, River basin development, Behr El Jebel Basin(Sudan), Behr El Eraf Basin(Sudan), Dams, Regional planning.

Several joint Sudanese-Egyptian projects to reduce water losses in the swampy regions of the upper Nile River system in the Sudan are described. The projects encompass the basins of Behr El Jebel, Behr El Zeraf, Behr El Ghazal, Sobat, and the Machar marshes. Special attention is given to the Jonglei Canal Project in the Behr El Jebel and Behr El Zeraf Basins. An estimated 42 billion cu m of water are lost annually in the total area. This paper describes the hydrology of each basin and conservation measures planned, which include dams, diversion works, and embankments. At present Sudan's irrigation development is limited by the country's 18.5 billion cu m share of Nile waters; and additional 14 billion cu m are needed. In the Behr El Ghazal Basin all but 0.16 of the 13.97 billion cu m total annual average discharge is lost in the swamps. Three dams and a diversion canal will generate an estimated additional seven billion cu m. For the Sobat River Basin and Machar marshes some four billion cu m will be saved by proposed storage on the upper Baro River, banking of the Baro, and a diversion canal. The Jonglei Canal Project will divert part of the Behr El Jebel flow, which loses half of its discharge in the flanking swamps. West of the project area an estimated 3.7 million acres is suitable for irrigation. The project will also include banking works, use of Lakes Victoria, Kyoga, and Albert for long-term storage, and improving the carrying capacities of the two river channels. The water benefit will be 24.5 MM3/day after the second phase. (Lynch-Wisconsin)
W80-00447

REHABILITATION OF CATCHMENT AREAS IN MOUNTAIN REGIONS,
Bundesministerium fuer Wirtschaft, Bonn (Germany, F.R.)
G. Winckler.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2261-2266.

Descriptors: *Mountains, *Headwaters, *Soil erosion, *River basins, *Deforestation, *Environmental effects, Runoff, Gully erosion, Karst, Crop production, Pastures, Water management (applied), Land use, Planning, Watersheds (basins), Sedimentation, Sediment transport.

Agricultural production, animal husbandry, and timbering have intensified natural erosion in mountainous regions of the world and cause significant runoff resulting in further erosion, flood disasters, and sediment deposition. Such regions tend to have particularly high precipitation. Forests, the natural vegetation form in mountain areas, are being rapidly destroyed by fires, uncontrolled pasturing, and use of wood as fuel and timber. Deforestation results in gully and surface erosion and landslides. High discharge rates and volumes in headwaters cause deep washouts of river beds, slides of eroded banks, and soil transport; the latter leads to shallower river beds, shifting river courses, and flooding. Fertile soils is covered by sand, which also accumulates in irrigation and drainage facilities. With deforestation rainwater is no longer retained by the soil, and water reserves are unavailable for dry-weather periods; springs and rivers dry up, explaining the increasing occurrence of drought in these areas. The extension of agricultural production to marginal sites has drastically decreased soil fertility and caused erosion, including problems in areas where terrace irrigation using unsuitable methods is applied. To combat these problems, comprehensive land-use planning is needed, including vegetation conservation and restoration. At the global level attention must be drawn to increased karst development of mountain regions. (Lynch-Wisconsin)
W80-00469

EFFICACY, UPTAKE AND DISTRIBUTION OF DIFFERENT HERBICIDES IN THE WATER HYACINTH,
Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. for Phytomedicine.
For primary bibliographic entry see Field 5C.
W80-00519

URBAN STORMWATER POLLUTION: AN INVESTIGATION OF THE PROBLEM AND ITS CONTROL,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
For primary bibliographic entry see Field 5B.
W80-00525

PLANNING STATUS REPORT, WATER RESOURCES APPRAISALS FOR HYDROELECTRIC LICENSING: LOWER ARKANSAS RIVER BASIN-ARKANSAS, COLORADO, KANSAS, NEW MEXICO, OKLAHOMA AND TEXAS,
Federal Energy Regulatory Commission, Washington, DC. Office of Electric Power Regulation.
For primary bibliographic entry see Field 6D.
W80-00533

FLOOD HAZARD ANALYSES, LITTLE OSSIPEE RIVER, TOWNS OF ACTON, NEWFIELD AND SHAPLEIGH, MAINE, YORK COUNTY.
Soil Conservation Service, Orono, ME.
For primary bibliographic entry see Field 2E.
W80-00535

FLOOD PLAIN INFORMATION: BAYOU BONFOUCA-BAYOU VINCENT W-14 MAIN DIVERSION CANAL DOUBLOON BRANCH-FRENCH BRANCH, SLIDELL, LOUISIANA AND VICINITY,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W80-00536

FLOOD PLAIN INFORMATION: OHIO RIVER, HANCOCK COUNTY, KENTUCKY,
Army Engineer District, Louisville, KY.
For primary bibliographic entry see Field 2E.
W80-00537

SPECIAL FLOOD HAZARD INFORMATION REPORT: TYGART RIVER, TAYLOR COUNTY, WEST VIRGINIA,
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 2E.
W80-00538

FLOOD PLAIN INFORMATION: OHIO RIVER, BOONE COUNTY, KENTUCKY,
Army Engineer District, Louisville, KY.
For primary bibliographic entry see Field 2E.
W80-00539

FLOOD PLAIN INFORMATION: BATON ROUGE, LOUISIANA, NO. 5, CYPRESS BAYOU AND TRIBUTARIES,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W80-00540

FLOOD PLAIN INFORMATION: BATON ROUGE, LOUISIANA, NO 4, HURRICANE CREEK, MONTE SANO BAYOU AND TRIBUTARIES,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W80-00541

GUIDELINES FOR URBAN DEVELOPMENT IN LOUISIANA'S COASTAL WETLANDS,
New Orleans Univ., LA. Urban Studies Inst.
For primary bibliographic entry see Field 4C.
W80-00547

IMPACT ASSESSMENT OF WATER RESOURCE DEVELOPMENT ACTIVITIES: A DUAL MATRIX APPROACH,
Fish and Wildlife Service, Kearneyville, WV. Water Resources Analysis.
For primary bibliographic entry see Field 6B.
W80-00550

OPTIMAL MANAGEMENT OF A MULTIRESERVOIR WATER SUPPLY SYSTEM,
IBM Scientific Center, Haifa (Israel).
S. Gal.
Water Resources Research, Vol. 15, No. 4, p 737-749, August 1979. 2 fig, 8 tab, 12 ref, 1 append.

Descriptors: *Water management(Applied), *Reservoirs, *Water supply, *Optimization, *Methodology, *Stochastic processes, *Dynamic programming, *Parameter iteration method, Water policy, Inflow, Equations, Pumping, Flood control, Costs, Simulation analysis, Constraints, Mathematical models, Systems analysis, Lake Kinneret(Israel).

Presented is a pilot study of a method for finding an approximation for the optimal policy of a dynamic system which depends on stochastic state variables. The systems considered are multi-reservoir water supply systems whose (stochastic) state variables are the quantities of water in each reservoir and some previous inflows which affect future inflows. Of special importance is the three-reservoir system which represents the major part of Israel's water supply system: Lake Kinneret and two underground aquifers. This system can be represented by five stochastic state variables: the quantities of water in each of the three reservoirs and the inflows into the Kinneret for the two previous months. Since this system is too large to be solved by the usual dynamic programming approach, a method was devised herein for obtaining an approximate solution which does not consume too much time or space. This method is referred to as the parameters iteration method. it has been tested on a smaller system containing only three stochastic state variables: the amount of water in the Kinneret and two previous monthly inflows. The results were satisfactory in the sense that the approximate solution obtained by this method was as good as the optimal solution obtained by a dynamic programming approach to the same problem. Thus it can be expected that the parameter iteration method would be efficient for the three reservoir problems as well as for larger ones. (Bell-Graf--Connell)
W80-00583

CONSERVATION BENCH TERRACES FOR RICE IN A SUBHUMID CLIMATE,
Central Soil and Water Conservation Research Inst., Agra (India).
For primary bibliographic entry see Field 3F.
W80-00595

4B. Groundwater Management

ISOTOPE HYDROLOGY.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 4A.
W80-00421

THE RESPONSE OF GROUNDWATER SYSTEMS TO DROUGHT,
Water Resources Commission, Sidney (Australia).
W. H. Williamson.
In: Water Management and Development, Proceedings of the United Nations Water Conference;

Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2125-2141.

Descriptors: *Droughts, *Australia, *Groundwater, *Aquifers, *Water supply, Groundwater recharge, Water management(Applied), Hydrogeology, Geology, Hydrology, Wells, Water sources, Surface waters, Water resources development, Planning, Arid lands, Water storage, Storage flow ratio, Salinity, Rainfall.

A review of several case histories, primarily Australian, of effects of drought on groundwater resources demonstrates that even where there is a substantial effect, groundwater is generally a far more reliable source than surface waters. Under favorable circumstances yields of bores or wells are relatively unaffected by drought, even though streams cease to flow and surface storages are dry. The concept of storage/flow ratios (storage upstream of a cross-section to flow past the section) offers a useful approach to characterizing the groundwater regime in terms of quantifying likely effects of a drought; a high ratio (expressed in years) indicates a drought will have little effect on groundwater. The ratio should be used in conjunction with the nature of the aquifer system and the pattern of recharge amount and frequency. Geology is the dominant factor influencing groundwater conditions, controlling an aquifer's storage volume, hydraulic characteristics, recharge and extraction rates, and usually strongly influences water quality. Geological formations can be grouped into three categories in terms of aquifers: (1) unconsolidated sediments, (2) porous rocks, and (3) fractured rocks. Climate, topography, vegetation, and soil cover also affect groundwater. Case histories include the Australian Capital Territory, Paroo calcrete, Weipa Peninsula, Gnangara sand beds, Great Australian Basin, and Hunter Valley in Australia, and Edwards limestone in Texas. (Lynch-Wisconsin)
W80-00462

METHODS OF GROUND-WATER PROTECTION FROM POLLUTION,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
V. M. Goldberg.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2145-2161.

Descriptors: *Water pollution control, *Groundwater, *Aquifers, *Hydrogeology, *Wells, Industrial wastes, Fertilizers, Pesticides, Agricultural runoff, Domestic-wastes, Salinity, Effluents, Forecasting, Observations wells, Potable water, Permeability.

The principle sources of groundwater pollution are: (1) industrial wastes, especially industrial sewage; (2) domestic effluents and waste; (3) agricultural fertilizers and pesticides; and (4) natural unconditioned surface and ground waters. The latter contain high mineralization with components which exceed permissible drinking water standards. Industrial effluents are the most important source of groundwater contamination, especially surface waste reservoirs--settling tanks, sludge accumulation tanks, gold dumps, storage tanks, evaporation tanks, and tailing ponds. Fresh groundwater is of greatest concern, but waters of high mineralization may be responsible for salinization of fresh groundwater. The extent of groundwater pollution depends on thickness and permeability of deposits overlying the aquifer, as well as on groundwater depth, the ratio of pressure heads of the aquifer, and properties of the pollutant which may change rock structure and permeability. Methods of predicting groundwater contamination on and quality at water intakes are discussed. Measures for protecting groundwater from pollution include: (1) control of industrial siting with regard to hydrogeology, (2) creation of a network of observation wells to monitor contamination, (3) elimination of abandoned and flowing wells, (4) regulating groundwater withdrawal, (5) sanitary control at water intakes, (6) construction of a series of wells to intercept polluted groundwater, and (7) water injection into the aquifer. (Lynch-Wisconsin)
W80-00463

GROUND-WATER CONDITIONS AND POTENTIAL FOR ARTIFICIAL RECHARGE IN LUCERNE VALLEY, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
D. H. Schaefer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 349, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-118, January 1979. 37 p, 13 fig, 4 tab, 17 ref.

Descriptors: *Groundwater resources, *Water quality, *Aquifer characteristics, *Drawdown, *Irrigation, Water wells, Overdraft, Water levels, Hydrogeology, Groundwater availability, Water supply, Water utilization, Artificial recharge, Potential water supply, Planning, California, *Lucerne Valley, *San Bernardino County(CA).

The water level in two areas of Lucerne Valley in California has declined more than 100 feet since 1917, including 60 feet from 1954 to 1976. These declines are the result of pumping for the irrigation of alfalfa. The lowering of water levels has caused many shallow domestic wells to go dry. Well yields in the valley generally are between 10 and 1,000 gallons per minute. About 240,000 acre-feet of ground water was withdrawn between 1950 and 1976. About 1,750,000 acre-feet remains in storage. Water of poor quality underlies the valley around Lucerne Lake. There was no definable movement of this water from 1954 to 1976, but the possibility exists for future movement toward centers of pumping. Lucerne Valley may be hydrologically suitable for artificial-recharge operations. (Woodard-USGS)
W80-00763

GROUND WATER IN DALE VALLEY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
A. C. Randall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 804, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-120, 1979. 85 p, 17 fig, 7 tab, 29 ref.

Descriptors: *Aquifer management, *Artesian aquifers, *Glacial aquifers, *Computer models, *Saline water intrusion, Aquifer characteristics, Water wells, Pumping, Water yield, Drawdown, Water levels, Water supply, Projections, Water quality, Chemical analysis, New York, *Dale Valley(NY), *Wyoming County(NY).

Dale Valley is a broad valley segment, enlarged by glacial erosion, at the headwaters of Little Tonawanda Creek near Warsaw, New York. A thin, shallow alluvial aquifer immediately underlies the valley floor but is little used. A deeper gravel aquifer, buried beneath many feet of lake deposits, is tapped by several industrial wells. A finite-difference digital model treated the deep aquifer as two-dimensional with recharge and discharge through a confining layer. It was calibrated by simulating (1) natural conditions, (2) an 18-day aquifer test, and (3) 91 days of well-field operation. Streamflow records and model simulations suggest that in moderately wet years such as 1974, a demand of 750 gallons per minute could be met by withdrawal from the creek and from the aquifer without excessive drawdown at production wells or existing domestic wells. With reasonable but unverified model adjustments to simulate an unusually dry year, the model predicts that a demand of 600 gallons per minute could be met from the same sources. Water high in chloride has migrated from bedrock into parts of the deep aquifer. Industrial pumpage, faults in the bedrock, and the natural flow system may be responsible. (Woodard-USGS)
W80-00768

A PRELIMINARY APPRAISAL OF THE IMPACT OF AGRICULTURE ON GROUND-WATER AVAILABILITY IN SOUTHWEST GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
L. D. Pollard, R. G. Grantham, and H. E. Blanchard, Jr.
Geological Survey Water-Resources Investigations 79-7 (open-file report), October 1978. 22 p, 11 fig, 4 plates, 3 tab, 21 ref.

Descriptors: *Groundwater availability, *Water quality, *Agricultural chemicals, *Groundwater recharge, *Irrigation wells, Aquifer management, Pumping, Water yield, Evaluation, *Southwest Georgia.

Irrigated acreage in the 20-county study area in southwest Georgia increased from 130,000 acres in 1976 to 261,000 in 1977. Acreage irrigated entirely by ground water increased 85 percent for the same period. The largest quantity of ground water used for irrigation was in the Dougherty Plain district, where 92 percent of supplemental irrigation water comes from wells. The total amount of water pumped for irrigation in the Dougherty Plain in 1977 was more than 42 billion gallons, 30 billion gallons more than in 1976. There were no detectable concentrations of selected organic compounds and trace metals used in agricultural chemicals above the recommended limits for public consumption in 19 wells sampled for chemical analyses. Although nitrate concentrations were not above the recommended limits for drinking water, the presence of nitrate in amounts ranging from 0.3 to 7.8 milligrams per liter in wells in the Dougherty Plain possibly indicate the downward movement of soluble nitrate, a byproduct of fertilizer, into the ground-water reservoir. (Woodard-USGS)
W80-00770

4C. Effects On Water Of Man's Non-Water Activities

GUIDELINES FOR URBAN DEVELOPMENT IN LOUISIANA'S COASTAL WETLANDS,
New Orleans Univ., LA. Urban Studies Inst.
A. J. Mumphrey, Jr., and J. S. Brooks.
Coastal Zone Management Journal, Vol. 4, No. 1/2, p 165-187, January-February 1978. 2 fig, 45 ref.

Descriptors: *Wetlands, *Flooding, *Louisiana, *Coastal environments, *Runoff, *Land drainage, *Coastal development, *Methodology, *Coastal zone management, Land use, Planning, Regulatory measures, Flood protection, Water pollution control, Aquatic habitat, Coastal areas, Water resources planning, Pollution, Urban development.

The authors present a methodology which is intended to be used by organizations interested in urban development of wetlands. The study does not recommend development in Louisiana's wetlands and flood prone areas, but discusses mitigating practices which might be employed in the development process which would minimize environmental damage. Recommended are familiarization with U.S. Army Corps of Engineers dredge and fill permitting practices and requirements of the National Environmental Policy Act. Also discussed in the construction phase are adding deep soil minerals to stabilize a site, selective clearing of vegetation to avoid severe erosion, use of sheet piling to avoid sinking in construction of roads next to canals, and use of sewer lines rather than septic tanks to avoid wetland soil contamination from sewage. Recommended flood protection guidelines include: restriction of uses to those having least impact, such as agriculture, public open space, and temporary uses; under permitted exceptions, allow only structures built to resist flooding, flotation and water seepage; designing drainage systems to minimize runoff; and institution of local solid waste programs to mitigate effects of processes such as dumping in sanitary landfills. (Arnold-NC)
W80-00547

THE IMPACT OF DREDGED HOLES ON OXYGEN DEMAND IN THE LOWER BAY, NEW YORK HARBOR,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
S. M. Swartz, and B. H. Brinkhuis.
Special Report 17, Reference 78-5, December 1978. 87 p, 18 fig, 18 ref, 2 append.

Descriptors: *Dredging, *Oxygen demand, *Circulation, *Sands, *Mining, Environmental effects, Resources development, Sediments, Bays, Organic matter, Ecosystems, *New York Harbor, Dredged holes, Environmental impact.

The purpose was to determine the effects, if any, of dredged holes in the seabed of the Lower Bay of New York Harbor on oxygen dynamics in the water column and surficial sediments. The data were collected during five cruises in the Lower Bay between February 1978 and August 1978. Samples of surficial sediments were analyzed for organic carbon, acid-soluble sulfide, and oxygen consumption rate. In addition, the water column at many of the stations was sampled at various depths to profile temperature, salinity, and dissolved oxygen. The results show that the presence of dredged holes affects oxygen demand of the sediments and oxygen concentrations of the overlying waters. These effects are variable, and dependent on the location of the dredged holes. Lower oxygen concentrations were generally found in dredged holes on the West Bank. There was no effect of dredged holes on oxygen dynamics on the East Bank. This difference is ascribed to hydrodynamic dissimilarities between the East and West Banks, and the accumulation of fine organic matter only on the West Bank. Bottom topography effects on circulation can be an important factor in controlling the dynamic balance between oxygen consuming processes in the sediments and water column, and physical processes in the water column which supply oxygen to the bottom waters. (NOAA)
W80-00694

EFFECTS OF URBANIZATION ON THE MAGNITUDE AND FREQUENCY OF FLOODS IN NORTHEASTERN ILLINOIS,
Geological Survey, Champaign, IL. Water Resources Div.
H. E. Allen, Jr., and R. M. Bejcek.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 065, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-36, 1979. 48 p, 6 fig, 4 tab, 23 ref.

Descriptors: *Urbanization, *Flood frequency, *Flood discharge, *Peak discharge, *Illinois, Storm runoff, Flood forecasting, Analytical techniques, Estimating equations, Regression analysis, Gaging stations, Flow characteristics, Land use, Paving, Drainage area, Channel morphology, *Northeastern Illinois, Watershed characteristics.

Changes in land use associated with urbanization have increased flood-peak discharges in northeastern Illinois by factors up to 3.2. Techniques are presented for estimating the magnitude and frequency of floods in the urban environment of northeastern Illinois, and for estimating probable changes in flood characteristics that may be expected to accompany progressive urbanization. Suggestions also are offered for estimating the effects of urbanization on flood characteristics in areas other than northeastern Illinois. Three variables, drainage area, channel slope, and percent imperviousness (an urbanization factor), are used to estimate flood magnitudes for frequencies ranging from 2 to 500 years. Multiple regression analyses were used to relate flood-discharge data to the above watershed characteristics for 103 gaged watersheds. These watersheds ranged in drainage area from 0.07 to 630 square miles, in channel slope from 1.1 to 115 feet per mile, and in imperviousness from 1 to 39 percent. (Woodard-USGS)
W80-00769

STORMWATER-RUNOFF DATA FOR A COMMERCIAL AREA, BROWARD COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. A. Miller, H. C. Mattraw, Jr., and J. Hardee.
Geological Survey open-file report 79-982, 1979. 127 p, 2 fig, 4 tab, 7 ref.

Descriptors: *Storm runoff, *Paving, *Water quality, *Chemical analysis, *Rainfall-runoff relationships, Shopping center, Parking lot, Impervious area, Chemical load, *Fort Lauderdale(Fla).

Rainfall, stormwater discharge, and water-quality data for rainfall and runoff are summarized for a commercial area in Fort Lauderdale, Florida. Loads for 20 water-quality constituents were computed for runoff from 31 storms between May 1975 and June 1977. The basin of 20.4 acres contains a shopping center with adjacent parking, and is 97.9 percent impervious. (Woodard-USGS)
W80-00772

DETERMINATION OF PEAK DISCHARGE FROM RAINFALL DATA FOR URBANIZED BASINS, WICHITA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-00774

4D. Watershed Protection

REHABILITATION OF CATCHMENT AREAS IN MOUNTAIN REGIONS,
Bundesministerium fuer Wirtschaft, Bonn (Germany, F.R.)
For primary bibliographic entry see Field 4A.
W80-00469

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1978,
Geological Survey, Albuquerque, NM. Water Resources Div.
R. R. Cruz.
Geological Survey open-file report 79-985, May 1979. 23 p, 10 fig, 5 tab, 3 ref.

Descriptors: *Groundwater resources, *Water wells, *Pumping, *Water yield, *Water quality, Water level fluctuations, Potentiometric level, Water analysis, Chemical analysis, Observation wells, Boreholes, Aquifer management, Military reservations, *White Sands Missile Range(NM).

Ground-water data were collected in 1978 at White Sands Missile Range in south-central New Mexico. Total ground-water pumpage in 1978 was 692,045,700 gallons or 7,248,300 less than in 1977. Wells at the Post Headquarters produced 98 percent of the total volume. Water levels in test wells around the Post Headquarters well field show seasonal declines ranging from 14.78 feet to 0.71 feet. The water samples collected from the supply wells show that the chemical quality of the water is slightly better during the period of greatest declines. (Woodard-USGS)
W80-00764

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

THE USE OF THE ATP ASSAY FOR RAPID ASSESSMENT OF WATER QUALITY,
Dearborn Chemical Co. Ltd., Ottawa (Ontario). Dearborn Environmental Consulting Services.
Fisheries and Environment Canada. Inland Waters Directorate, Water Quality Branch, Ottawa, Canada. 1979. Technical Bulletin No. 109. 181 p, 44 fig, 40 tab, 105 ref, 3 append.

Descriptors: *Water quality, *Adenosine-triphosphate(ATP) assay, *Chlorination, *Analytical techniques, *Wastewater quality, Methodology, Biochemical oxygen demand, Assay, Laboratory tests, Water quality control.

This is a report on the evaluation of the feasibility of applying the adenosine triphosphate (ATP) assay to provide a more rapid indication of water quality and wastewater quality. The long term incubation times involved in standard bacterial enumeration methods and the biochemical oxygen demand (BOD5) methodology limit the applicability of these analytical results for process control; therefore, a short-term alternative is being sought. A comparison of ATP extraction methodology indicated that the boiling glycine and the homogenizing ATP extraction methods are more accurate and more precise than either the acetone-tris or acetone-tris-MgEDTA methods. The boiling glycine method is more applicable than the homogenizing method for field use. The ATP content of secondary effluent streams disinfected with chlorine was found to be significantly correlated with the results of conventional bacterial plating methods when the disinfection efficiency was varied over a wide range (50 to >99.99 percent kill). However, the relative response of the ATP assay and the plate counts differed by several orders of magnitude. The residual ATP content provided a better estimate of disinfected effluent quality and would appear to be a more meaningful process control parameter. Care must be exercised in the interpretation of ATP assay results and considerable knowledge concerning the response of the system to various inputs is necessary. (Iervolino-NC)
W80-00552

WATER QUALITY INVESTIGATION OF ESTUARIES OF GEORGIA, 1976,
Brunswick Junior Coll., GA.
For primary bibliographic entry see Field 2L.
W80-00553

PERSISTENCE OF CHLORINE IN COOLING WATER FROM ELECTRIC GENERATING STATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
G. F. Lee.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 105, No. EE4, Proceedings Paper 14777, p 757-773, August 1979. 9 fig, 6 tab, 6 ref, 1 append.

Descriptors: *Chlorine, *Cooling water, *Delaware River, Sampling, Chemical analysis, Thermal pollution, Thermal water, Heated water, Toxins, Fish toxins, Toxicity, Fouling, Powerplants, Rivers, Water pollution, Thermal plumes.

A study of the persistence of chlorine in the cooling water discharged to the Delaware River estuary by the Philadelphia Electric Company Eddystone Generating Station showed that potentially toxic levels of chlorine were present 1 hr to 2 hr after discharge for organisms (plankton) entrained in the thermal discharge plume. Based on consideration of chlorine persistence-time of exposure relationships that exist in cooling water thermal plumes, little or no toxicity would be expected to fish in the Delaware River due to the use of chlorine for condenser fouling control at the Eddystone Electric Generating Station. (Sims-ISWS)
W80-00581

TRACE ANALYSIS OF PHOSPHATES IN SMALL AQUEOUS VOLUMES,
Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Chemical Engineering.
W. Potman, and L. Lijklema.
Water Research, Vol. 13, No. 8, p 801-804, 1979. 1 fig, 5 tab, 7 ref.

Descriptors: *Phosphates, *Chemical analysis, *Connate water, Chemicals, Phosphorus, Phosphorus compounds, Analytical techniques, Equipment, Instrumentation, Aqueous solutions, Sediments, Water chemistry, Laboratory tests, Chemistry, Nutrients, Pollutants, Pollutant identification, Water pollution.

The indirect determination of trace amounts of phosphate through estimation of the molybdenum in the phosphomolybdic acid complex has been improved. The lower limit of spectrophotometric determination is about 0.10 microgram P. (Sims-ISWS)
W80-00589

RATE CONTROLLING PROCESSES IN THE RELEASE OF RADIUM-226 FROM URANIUM MILL TAILINGS, I. LEACHING STUDY,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
For primary bibliographic entry see Field 5B.
W80-00600

RATE CONTROLLING PROCESSES IN THE RELEASE OF RADIUM-226 FROM URANIUM MILL TAILINGS, II. KINETIC STUDY,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
For primary bibliographic entry see Field 5B.
W80-00601

DEGRADATION OF SELECTED POLYCYCLIC AROMATIC HYDROCARBONS IN COASTAL SEDIMENTS: IMPORTANCE OF MICROBES AND POLYCHAETE WORMS,
Skidaway Inst. of Oceanography, Savannah, GA.
W. S. Gardner, R. F. Lee, K. R. Tenore, and L. W. Smith.
Water, Air, and Soil Pollution, Vol. 11, No. 3, p 339-347, April 1979. 4 fig, 3 tab, 25 ref. NOAA 10-32-RR273-07 7.

Descriptors: *Sediments, *Coasts, *Microbial degradation, *Worms, Marine microorganisms, Marine biology, Organic compounds, Oil spills, Pollutants, Path of pollutants, Laboratory tests, Chemicals, Chemical analysis, Water pollution, Water quality, Polychaete worms, Polycyclic aromatic hydrocarbons.

Rates of degradation of polycyclic aromatic hydrocarbons (PAH) were examined after addition of crude oil enriched with anthracene, fluoranthene, benz(alpha)anthracene, and benzo(alpha)pyrene to coastal sediments in a laboratory (20 deg C) flowing seawater system. Three types of sediment (fine sand, medium sand, and marsh sediment) with and without the benthic polychaete worm, Capitella capitata, were used. After extraction from the sediment, PAH concentrations were measured by liquid chromatography with fluorescent detection. Microbial degradation was studied by incubating sediments with radioactive PAH and measuring subsequent production of 14CO2. Concentrations of the four PAH decreased significantly with time in fine and medium sized sands. PAH levels also decreased in marsh sediment, but trends were not significant (P less than 0.05). C. capitata stimulated PAH degradation. Microbial degradation was more rapid in upper surfaces than in lower layers of the sediments. (Sims-ISWS)
W80-00613

A COMPARISON OF DYNAMIC AND STATIC HEAD SPACE AND SOLVENT EXTRACTION TECHNIQUES FOR THE DETERMINATION OF TRIHALOMETHANES IN WATER,
Environmental Health Directorate, Ottawa (Ontario). Bureau of Chemical Hazards.
R. Otson, D. T. Williams, and P. D. Bothwell.
Environmental Science and Technology, Vol. 13, No. 8, p 936-939, August 1979. 5 tab, 12 ref.

Descriptors: *Water chemistry, *Pollutant identification, *Analytical techniques, Chemical analysis, Laboratory tests, Solvent extractions, Chemicals, Potable water, Water quality, Chemistry, Water pollution, *Trihalomethanes.

The dynamic head space (GS), solvent (hexane) extraction (SE), and static head space (HS) techniques utilizing Tenax GC columns, a 63Ni electron capture detector, and a Hall electrolytic conductivity detector were compared for the determination of trihalomethanes (THMs) in water. Potable water samples ranging from 29 to 150 microgram/liter CHCl3, from 2.3 to 10.1 microgram/liter CHBrCl2, and from less than 0.5 to 1.8 microgram/liter CHBr2Cl were analyzed in triplicate. The relative standard deviation between THM values obtained by the three techniques was 9-10% for CHCl3, 3-24% for CHBrCl2, and 13-61% for CHBr2Cl. Although the GS technique was the most sensitive, the SE technique gave comparable precision, while the HS technique showed relatively poor precision and sensitivity. The SE technique was recommended for routine monitoring since it requires no special equipment and allows more analyses/hour than the GS technique. (Sims-ISWS)
W80-00617

POLYCHLORINATED BIPHENYLS AND CHLORINATED PESTICIDES IN SOILS OF THE EVERGLADES NATIONAL PARK AND ADJACENT AGRICULTURAL AREAS,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
A. G. Requejo, R. H. West, P. G. Hatcher, and P. A. McGillivary.
Environmental Science and Technology, Vol. 13, No. 8, p 931-935, August 1979. 2 fig, 4 tab, 31 ref. NPS 52 97-1008-182.

Descriptors: *Polychlorinated biphenyls, *Chlorinated hydrocarbon pesticides, *Swamps, *Agricultural chemicals, *Florida, Pollutants, Pollutant identification, Path of pollutants, Soils, Sediments, Soil contamination, Sampling, Chemical analysis, Pesticides, Farm wastes, Farm practices, Agriculture, *Everglades National Park.

Soil samples collected from the eastern Everglades National Park and adjacent farmlands were analyzed for certain chlorinated pesticides and polychlorinated biphenyls (PCBs). The results indicate that although concentrations of PCBs, 1,1,1-trichloro-2,2 bis(p-chlorophenyl) ethane (DDT), and chlordane are high at the agricultural sites, little contamination of parklands has occurred. Pesticide concentrations decrease by two orders of magnitude (to unit parts per billion levels) within 2 km of the agricultural sites sampled. Individual contributions of four Aroclors (1242, 1248, 1254, and 1260), calculated using pattern recognition techniques, suggest that plastic sheeting used in agricultural fields is a local source of PCBs. A comparison of the results to those from other environments revealed that PCB and DDT concentrations found within the Park (less than 1.0-33 and less than 1.0-22 ppb, respectively) are as low as any site in North America. (Sims-ISWS)
W80-00618

WATER QUALITY IN CHANNEL CATFISH PRODUCTION PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
C. E. Boyd, R. P. Romaire, and E. Johnston.
Journal of Environmental Quality, Vol. 8, No. 3, p 423-429, July-September 1979. 9 fig, 4 tab, 12 ref.

Descriptors: *Ponds, *Alabama, *Fish, *Channel catfish, *Water quality, Sampling, On-site investigations, Data processing, Chlorophyll, Secchi disks, Algae, Phytoplankton, Nitrates, Nitrogen, Nitrogen compounds, Ammonia, Carbon dioxide, Chemical oxygen demand, Phosphorus, Dissolved oxygen, Mathematical models, *Auburn(AL).

A number of water quality variables were measured at 1- to 2-week intervals in five channel catfish production ponds at Auburn, Alabama, during the 1978 growing season. Concentrations of most variables increased with time since feeding rates were progressively increased as fish grew. The DO concentration at dawn was often lower than 2.0 mg/liter during August and September. Emergency aeration was used one or more times in each pond to minimize the danger of fish kills because of low DO. In addition, unionized ammonia (NH3) and carbon dioxide concentrations were occasionally high enough to possibly have had adverse effects on fish. A computer simulation model for predicting the early morning DO concentration in ponds proved efficient. The average difference between measured and predicted DO concentration, disregarding sign, was 0.47 mg/liter for 30 trials. Spillway discharge from channel catfish ponds was more concentrated in pollutants than streams near Auburn. (Sims-ISWS)
W80-00619

CHEMICAL SEEPAGE FROM A TAIL WATER RECOVERY PIT TO ADJACENT GROUND WATER,
Nebraska Univ., Lincoln. Inst. of Agricultural and Natural Resources.
For primary bibliographic entry see Field 5B.
W80-00621

SEDIMENT AND NUTRIENT YIELD FROM RESIDENTIAL CONSTRUCTION SITES,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W80-00622

A WATER QUALITY STUDY OF A STRETCH OF THE RIVER TIGRIS,
Mosul Univ. (Iraq). Coll. of Engineering.
T. A. Mahmoud, and S. Ahmad.
Water Research, Vol 13, No 8, p 785-790, 1979. 5 fig, 2 tab, 6 ref.

Descriptors: *Water quality, *Sampling, *Water pollution, Pollutants, Pollutant identification, Sewage, Effluents, Sewage effluents, Waste water disposal, Chemical analysis, Biochemical oxygen demand, Dissolved oxygen, Model studies, Mathematical models, Path of pollutants, *Tigris River(Iraq), *Iraq.

A water quality study was conducted on a stretch of the River Tigris in Iraq near the city of Mosul for qualitative and quantitative assessment of pollution due to raw wastewater discharge from a number of outfalls located along its banks. A stretch of 18 km of the river was divided into a number of sections, and each section was divided into a number of strips along the direction of flow. The strip technique was adopted for comparing the observed and calculated values of dissolved oxygen and for identifying abnormalities. For theoretical analysis, three available mathematical techniques, namely, Streeter-Phelps, Dobbins modification of Streeter-Phelps, and the Rational method, were utilized. Due to poor dispersion and improper mixing of the wastewater and river water, a considerable stretch of the river close to the west bank is polluted, which adversely affects the aesthetic and cultural use of the water front. However, the results indicated that the river Tigris as a whole recovers from the effects of raw wastewater discharges. (Sims-ISWS)
W80-00623

WEAK AND STRONG ACIDS IN THE SURFACE WATERS OF THE TOVDAL REGION IN S. NORWAY,
Central Electricity Generating Board, Leatherhead (England). Research Lab.
For primary bibliographic entry see Field 2K.
W80-00624

EVALUATION OF AN ENZYMATIC METHOD FOR ORTHOPHOSPHATE DETERMINATION IN FRESHWATERS,
Ministry of Agriculture, Crumlin (Northern Ireland). Freshwater Biological Investigation Unit.
R. J. Stevens.
Water Research, Vol 13, No 8, p 763-770, 1979. 5 fig, 4 tab, 29 ref.

Descriptors: *Pollutant identification, *Phosphates, *Freshwater, *Chemical analysis, Analytical techniques, Laboratory tests, Water chemistry, Enzymes, Chemicals, Chemistry, Pollutants, Water pollution.

An automated enzymatic method for orthophosphate determination was applied to freshwaters. The basis of the assay was the reaction of glyceraldehyde-3-phosphate with orthophosphate to form 1,3-diphosphoglycerate in the presence of glyceral-

dehyde-3-phosphate dehydrogenase and oxidized nicotinaminde-adenine dinucleotide. Nicotinamide-adenine dinucleotide. Nicotinamide-adenine dinucleotide, reduced form was produced in equimolar amounts to orthophosphate and was determined colorimetrically. The method was tested up to 200 micrograms P/l and had a limit of detection of 5 micrograms P/1. Silicate or arsenite did not interfere, but arsenate caused a positive interference. The results of the analysis of 100 fresh-water samples by the enzymatic orthophosphate method and the well-established soluble reactive phosphorus method indicated that a form of phosphorus was present which was determined as soluble reactive phosphorus but not as enzymatic orthophosphate. The mean soluble reactive phosphorus concentration was 71 micrograms P/1. A hydrous ferric oxide-orthophosphate complex was postulated to explain why soluble reactive phosphorus was greater than enzymatic orthophosphate. (Sims-ISWS)
W80-00625

TIME SERIES ANALYSIS OF AMMONIA IN THE PASSAIC RIVER,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5C.
W80-00638

A HISTORY OF MERCURY LEVELS IN SWEDISH FAUNA,
Naturhistoriska Riksmuseet, Stockholm (Sweden). Section for Invertebrate Zoology.
A. Johnels, G. Tyler, and T. Westermark.
Ambio, Vol. 8, No. 4, p 160-168, 1979. 10 fig, 2 tab, 64 ref.

Descriptors: *Mercury, *Path of pollutants, Industrial wastes, Chemical wastes, Regulation, Heavy metals, Food chains, Seasonal, Water chemistry, Animal metabolism, Toxicity, Birds, Plant physiology, Fish physiology, *Sweden, *Tissue analysis, *Bioaccumulation, Finland.

The present article primarily describes research regarding levels of mercury in Swedish fauna and flora, with a concentration on higher animals. Particular emphasis is laid on the increase of levels from the 19th century to the present (the last 150 years) caused by increased industrial activity. The decrease since 1966, which is due to Finnish-Swedish regulations and prohibitions in the use of mercury and its compounds, is also discussed. Mercury in industrial emissions and its long range transport and deposition still pose a threat to fauna which feed on aquatic organisms. (Deal-EIS)
W80-00649

THE RESPONSE OF COHO SALMON AND GUPPIES TO 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD) IN WATER,
Pacific Northwest Forest and Range Experiment Station, Corvallis, OR. Forestry Sciences Lab.
R. A. Miller, L. A. Norris, and B. R. Loper.
Transactions of the American Fisheries Society, Vol. 108, p 401-407, 1979. 1 fig, 4 tab, 11 ref.

Descriptors: *Sockeye salmon, *2,4,5-T, *Pesticide toxicity, Bioassay herbicides, Toxicity, Growth rates, Fish physiology, Animal pathology, Fish diseases, Mortality, Growth stages, Path of pollutants, Mode of action, *TCDD, *Dioxin, *Guppies, Fin disease.

TCDD exposure for 96 hours at 0.54 ng/g (amount of TCDD in test container per gram of wet body weight) had no effect on food consumption, weight gain, or survival of young coho salmon (Oncorhynchus kisutch) during a 60-day postexposure period in a static-water toxicity test. Growth and survival 114 days after exposure to 5.4 ng/g TCDD were reduced, and the reductions were greater after 24 hours than after 12 hours exposure to TCDD. These effects were first observed 56 days after exposure. The body burden of TCDD in young coho salmon 114 days after exposure increased with both the level and duration of exposure. The half-life of the whole-body TCDD residues was at least 109 days after fish were placed in clean water. Guppies (Poecilia reticulata) exposed to 0.8 ng TCDD/g developed fin disease 42 days after exposure. There was a significant decrease in the diseased fin condition between 42 to 69 days after exposure. Guppies had no increase in fin disease after exposure to 0.08 ng/g TCDD. (Deal-EIS)
W80-00651

ACCLIMATION TO AMMONIA BY TILAPIA AUREA,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
B. D. Redner, and R. R. Stickney.
Transactions of the American Fisheries Society, Vol. 108, p 383-388, 1979. 2 tab, 30 ref.

Descriptors: *Ammonia, *Tilapia, Bioassay, Toxicity, Lethal limit, Mortality, Cytological studies, Fish physiology, Fish diseases, Animal pathology, Water chemistry, Dissolved oxygen, Aquiculture, *Acclimation, *Tissue analysis.

An automatic flow-through dosing apparatus was used to determine the effect on Tilapia aurea of acute and chronic exposure to un-ionized ammonia. For fish not exposed to ammonia prior to acute testing, the 48-hour median lethal concentration (LC50) was 2.40 mg/liter un-ionized ammonia. After fish were exposed to sublethal concentrations of un-ionized ammonia (0.43-0.53 mg/liter) for 35 days, concentrations as high as 3.4 mg/liter caused no mortalities within 48 hours. Histopathological changes occurred in the gills of fish given both nonlethal and acute doses of ammonia. Capillary congestion, hemorrhaging, and telangiectasis were common symptoms of gill abnormalities. (Deal-EIS)
W80-00653

THE SURVIVAL OF SMOLTS OF SALMON SALMO SALAR L. AT LOW CONCENTRATIONS OF DISSOLVED OXYGEN,
Water Pollution Research Lab., Stevenage (England).
J. S. Alabaster, D. G. Shurben, and M. J. Mallett.
Journal of Fish Biology, Vol. 15, p 1-8, 1979. 3 fig, 2 tab, 12 ref.

Descriptors: *Atlantic salmon, *Mortality, *Dissolved oxygen, Bioassay, Smolt, Oxygen requirements, Salinity, Estuaries, Toxicity, Sea water, Fish physiology, Fish migration.

The survival of Atlantic salmon smolts on sudden exposure to low constant concentrations of dissolved oxygen (DO) has been measured under laboratory conditions. The 3-d LC50 is about 3 mg/l in freshwater and about 2.5 mg/l in 30% and 80% sea water, even for fish acclimated for several days to low concentrations of DO and high salinity. Median threshold concentrations of DO are probably close to 3.3 and 2.6 mg/l respectively. (Deal-EIS)
W80-00655

TOTAL AND METHYLMERCURY LEVELS IN THREE SPECIES OF WHELKS,
Shimonoseki Univ. of Fisheries (Japan). Dept. of Food Science and Technology.
T. Ueda, and M. Takeda.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 6, p 763-769, 1979. 10 fig, 7 tab, 8 ref.

Descriptors: *Mercury, *Animal physiology, Animal metabolism, Crustaceans, Absorption, Heavy metals, Chemical analysis, Path of poliutants, Water chemistry, Statistical analysis, Molluscs, Japan, *Tissue analysis, *Bioaccumulation, *Methylmercury.

Determination of the total and methylmercury levels were carried out on muscle and midgut from three species of whelks, Buccinum tenuissimum Buccinum striatissimum, and Buccinum tsubai, caught in the southwestern waters of the Japan Sea. Both total and methylmercury levels depend on the number of operculum circulii. There is a linear relationship between the total mercury concentration (T-Hg) in the muscle and that in the mid-gut, where the first regression coefficient (m) was about 2. A similar relationship was found between the methylmercury concentrations (MeHg) in the two tissues, though the m was 1.29. The ratio of T-Hg to MeHg in the muscle was 1:0.95, whereas it was 1:0.65 in the mid-gut. These facts suggest the demethylation from methylmercury in the mid-gut. (Deal-EIS)
W80-00656

TRACE METALS IN SEADUCKS OF THE FRASER RIVER DELTA INTERTIDAL AREA, BRITISH COLUMBIA,
Canadian Wildlife Service, Delta (British Columbia).
K. Vermeer, and D. B. Peakall.
Marine Pollution Bulletin, Vol. 10, p 189-193, 1979. 1 fig, 5 tab, 20 ref.

Descriptors: *Metals, *Greater Scaup Duck, *Animal physiology, Path of pollutants, Silver, Copper, Lead, Zinc, Mercury, Food habits, Sewage effluents, Outlets, Chemical analysis, Intertidal areas, Bioindicators, Toxicity, *Surf scoter duck, *Tissue analysis, *Bioaccumulation, British Columbia, Fraser River.

Surf Scoters and Greater Scaup and samples of species which comprise the major part of their diets, from Iona Island and Roberts Bank tidal flats, near Vancouver, British Columbia, were analyzed for metal residues. Significantly higher silver, copper, lead and zinc levels were found in Greater Scaup than Surf Scoters. The latter species had higher mercury levels. Differences in residue levels between the species reflect interspecific variation in prey as well as feeding habitat. Significantly higher silver, mercury, lead and zinc in Surf Scoters and silver and lead in Greater Scaup observed at Iona Island than at Roberts Bank can be explained by higher levels of those metals occurring in a more metal-contaminated prey and sediment near the Iona Island sewer outfall. Ducks feeding on organisms in different intertidal zones show different accumulation of metal residues and constitute valuable indicators of pathways of toxic chemicals in specific estuarine regions. (Deal-EIS)
W80-00657

THE CONCENTRATION AND SPECIATION OF ARSENIC IN MARINE MACRO-ALGAE,
Skidway Inst. of Oceanography, Savannah, GA.
J. G. Sanders.
Estuarine and Coastal Marine Science, Vol. 9, p 95-99, 1979. 2 tab, 17 ref.

Descriptors: *Arsenic compounds, *Marine algae, Phaeophyta, Chlorophyta, Rhodophyta, Chemical analysis, Metabolism, Cytological studies, Path of pollutants, Absorption, Chemical reactions, Organic arsenic, *Arsenic, Inorganic arsenic.

Arsenic concentration of marine algae varies significantly, ranging from an average of 10.3 microgram/g in the Phaeophyceae to 1.54 microgram/g in the Chlorophyceae and 1.43 microgram/g in the Rhodophyceae. The chemical speciation is also significantly different, with the Phaeophyceae containing an average of 22% inorganic arsenic, and the Chlorophyceae and Rhodophyceae containing about 45% inorganic arsenic. The absolute concentration of inorganic arsenic is not significantly different between the classes, however, and may represent maximum tolerable levels for macro-algae. The variations in arsenic concentration are probably due to metabolic differences between classes, and not to differences in the amount of total available arsenic in the surrounding water. (Deal-EIS)
W80-00658

ELECTRIC FISH AS A TOOL FOR WATER QUALITY ASSESSMENT,
City Coll., New York.
P. Grove, and P. Moller.
Transactions of the American Fisheries Society, Vol. 108, p 420-421, 1979. 1 tab, 7 ref.

Descriptors: *Bioindicator, *Dieldrin, Methodology, Bioassays, Pesticide toxicity, Pesticide residues,

Fish physiology, Water quality, Chlorinated hydrocarbon pesticides, Fish behavior, *Malathion, *Brienomyrus, *Electric fish.

The temporal pattern of electric organ discharges emitted by a mormyrid fish, Brienomyrus niger, was affected by two broad spectrum insecticides, dieldrin and malathion, in concentrations of 1 microgram/liter. Such discharge patterns have potential as a sensitive and convenient bioassay tool. Further investigation is required to determine if the effects on discharge activity are pesticide-specific and concentration-dependent. (Deal-EIS)
W80-00659

SENSITIVITY OF ALASKAN FRESHWATER AND ANADROMOUS FISHES TO PRUDHOE BAY CRUDE OIL AND BENZENE,
National Marine Fisheries Service, Auke Bay, AK. Auke Bay Lab.
A. Moles, S. D. Rice, and S. Korn.
Transactions of the American Fisheries Society, Vol. 108, p 408-414, 1979. 1 fig, 3 tab, 24 ref.

Descriptors: *Toxicity, *Oil, *Growth stages, *Fish physiology, Bioassays, Juvenile growth stage, Salmonids, Pink salmon, Sockeye salmon, Chinook salmon, Lethal limit, Mortality, Water chemistry, Water temperature, Fish eggs, *Crude oil, *Benzene, *Sculpins, *Sticklebacks.

The sensitivity of various species and life stages of Alaskan freshwater and anadromous fishes to benzene and the water-soluble fraction of Prudhoe Bay crude oil was determined with 96-hour toxicity tests. Freshwater juveniles of the six salmonid species tested has similar sensitivities. Median tolerance limits (TLm's) of these salmonids for crude oil ranged from 2.7 to 4.4 mg/liter; TLm's of benzene ranged from 11.7 to 14.7 microl/liter. Threespine sticklebacks and, to a lesser extent, slimy sculpins were more tolerant than salmonids and had larger TLm's: threespine sticklebacks had a crude-oil TLm of 10.4 mg/liter and a benzene TLm of 24.8 microl/liter. Eggs of pink salmon and coho salmon were quite tolerant to crude oil (TLm > 12 mg/liter) and benzene (TLm = 339-542 microl/liter). Emergent fry were the most sensitive freshwater stage (crude-oil TLm = 8.0 mg/liter; benzene TLm = 12.3-17.1 microl/liter). Out-migrant salmonids tested in seawater were twice as sensitive as out-migrant salmonids tested in freshwater, apparently because of the additional stress of entering seawater and the physiological changes associated with this transition. Freshwater TLm's were 2.3-8.0 mg/liter for crude oil and 10.8-17.1 microl/liter for benzene. Corresponding seawater sensitivities were 1.1-3.6 mg/liter for crude oil and 5.5-8.5 microl/liter for benzene. (Deal-EIS)
W80-00660

THE SOURCE OF MUDDY ODOR IN BREAM (ABRAMIS BRAMA) FROM THE PORVOO SEA AREA (GULF OF FINLAND),
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
P.-E. Persson.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 883-890, 1979. 5 fig, 2 tab, 54 ref.

Descriptors: *Cyanophyta, *Eutrophication, *Actinomycetes, *Odor-producing algae, Nutrients, Water temperature, Commercial fish, Phytoplankton, Odor, Seasonal, Nitrogen, Phosphorus, Biomass, Water chemistry, Gulf of Finland, *Geosmin, *Bream.

The study area was a shallow, extremely eutrophic, somewhat brackish water bay on the south coast of Finland. Muddy odor in bream (Abramis brama) was significantly correlated with the amount of the blue-green alga Oscillatoria agardhii occurring in the phytoplankton. Cultures dominated by this alga contained the muddy odor compound, geosmin. The high concentrations of O. agardhii in the study area were caused by several interacting factors, of which the high nutrient concentration and the temperature of the water seemed to be especially important. Odoriferous actinomycetes isolated from the water produced the muddy odor compounds gwosmin and 2-methylisoborneol, but there seemed to be a lag time of several weeks between maximal concentrations of actinomycetes and development of off-flavors in the fish. (Deal-EIS)
W80-00661

EFFECTS OF BOTTOM SEDIMENTS ON THE SURVIVAL OF ENTEROBACTER AEROGENES IN SEAWATER,
Chinese Univ. of Hong Kong. Dept. of Biology.
K.-Y. Chan, S. H. Wong, and C. Y. Mak.
Marine Pollution Bulletin, Vol. 10, p 205-210, 1979. 5 fig, 2 tab, 27 ref.

Descriptors: *Bottom sediments, *Nutrients, *Coliforms, Bacteria, Particle size, Sediments, Bioindicator, Domestic wastes, Cytological studies, Growth rates, Sea water, Marine bacteria, Chemical analysis, *Enterobacter.

The survival of the coliform bacterium Enterobacter aerogenes in seawater was greatly affected by the underlying bottom sediments. The presence of sediments which contained higher concentrations of organic nutrients than the overlaying seawater prolonged the survival and even enabled growth of the bacterial cells. Results obtained from chemical analysis indicated that sediments of fine-grained, silt-clay type contained highest amounts of organic nutrients as compared with sediments with larger particle sizes such as silt and sand grains. Thus, nutrient contents of the sediments were found to be inversely proportional to sediment particle size. The degree of prolonged survival of E. aerogenes was also found to be inversely proportional to the size of the sediment particles presented. Release of the bound nutrients which became available to cells of E. aerogenes from sediments by action of waves and human activities can explain, at least in part, why high counts of coliform bacteria are obtained in coastal and beach waters. (Deal-EIS)
W80-00662

EFFECTS OF ORAL ADMINISTRATION OF CADMIUM ON FISH-V EFFECTS ON CALCIUM AND INORGANIC PHOSPHORUS EXCRETION IN THE CARP,
Kyushu Univ., Fukuoka (Japan). Dept. of Fisheries.
J. Koyama, and Y. Itazawa.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 6, p 691-694, 1979. 2 fig, 2 tab, 9 ref.

Descriptors: *Cadmium, *Fish physiology, *Toxicity, Animal metabolism, Calcium, Phosphorus, Heavy metals, Chlorides, Chemical analysis, Fish diets, Carp, *Teratogens.

The excretion rate of calcium increased in cadmium-administered carp, during the calcium-loaded period after its injection, owing not to elevation of calcium concentration in the urine but to the increased urine flow. The scoliosis developed in cadmium administered carp as detailed in the previous paper was considered to be attributable to low calcium in both the plasma and vertebrae. The low calcium was estimated to be due to overexcretion of calcium owing to degeneration of the renal tubules. The results of the present experiment seem to give support to the inference. Excretion of inorganic phosphorus in cadmium administered carp increased in both concentration and excretion rate for calcium-loaded and non-loaded periods. (Deal-EIS)
W80-00663

UPTAKE, BINDING AND CLEARANCE OF DIVALENT CADMIUM IN GLYCERA DIBRANCHIATA (ANNELIDA: POLYCHAETA),
San Francisco Univ., CA. Dept. of Biology.
M. A. Rice, and P. K. Chien.
Marine Biology, Vol. 53, p 33-39, 1979. 6 fig, 2 tab, 26 ref.

Descriptors: *Annelids, *Cadmium, *Absorption, Path of pollutants, Heavy metals, Ions, Worms, Hydrogen ion concentration, Proteins, Chemical analysis, Animal physiology, Animal metabolism, Potassium, Tracers, Cadmium radioisotopes, *Polychaetes, *Tissue analysis, *Bioaccumulation.

The bloodworm Glycera dibranchiata accumulates cadmium through the general body surface and the intestine. Absorption through the gut accounts for cadmium which rapidly binds to coelomic proteins. Intracoelomic injection of 109 Cd demonstrates that cadmium binds readily to hemoglobin and other proteins. The degree of cadmium binding is pH-dependent. The apparent pH of binding sites in body wall and musculature homogenates is 5.39. Cadmium ions injected into the coelom at 7 microg/l tissue increase proline incorporation rates into the positively charged hemoglobin (cathode fraction) by 15-fold in 3 days. A 3-fold increase of proline incorporation was observed in the anode hemoglobin fraction over the same time period. Radioactivity in various protein fractions decreases at different rates after injection of 109 Cd. Comparisons between the function of mammalian metallothionein and the coelomic fluid proteins of G. dibranchiata as a detoxification mechanism are discussed. (Deal-EIS)
W80-00664

BODY BURDEN OF CHROMIUM, COPPER, CADMIUM AND LEAD IN THE NEUSTONIC COPEPOD ANOMALOCERA PATERSONI (PONTELLIDAE) COLLECTED FROM THE MEDITERRANEAN SEA,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
G. G. Polikarpov, B. Oregioni, D. S. Parchevskaya, and G. Benayoun.
Marine Biology, Vol. 53, p 79-82, 1979. 2 fig, 5 tab, 10 ref.

Descriptors: *Copepods, *Metals, *Absorption, *Chromium, *Copper, *Cadmium, *Lead, Spectrophotometry, Chemical analysis, Animal metabolism, Animal physiology, Distribution patterns, *Tissue analysis, *Bioaccumulation.

The amounts of Cr, Cu, Cd and Pb in the copepod Anomalocera patersoni were determined for 47 individuals by flameless atomic absorption spectrophotometry. The following mean body burdens of these elements were obtained: Cr 0.6, Cu 13, Cd 0.5, Pb 1.5 nannog individual, or Cr 2.1, Cu 42, Cd 1.5 and Pb 4.8 nannog mg (dry weight). Cr, Cu and Cd contents did not differ significantly between males and females, however Pb did, with males having more. The data indicate that while the Cr, Cu and Pb body burden in these copepods follows the logarithmic normal distribution, Cd follows a normal distribution. Thus, the arithmetic means and the modes of Cd body burden are almost the same, while for the other elements the arithmetic means differ from the geometric means. This indicates that measurements of a few individuals suffice for estimating the mean body burden of Cd. On the other hand, many measurements are necessary for the body burden estimation of other elements, especially Cu. (Deal-EIS)
W80-00665

EFFECTS OF KUWAIT OILS ON FEEDING RATES OF COPEPODS,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
M. F. Spooner, and C. J. Corkett.
Marine Pollution Bulletin, Vol. 10, p 197-202, 1979. 6 tab, 18 ref.

Descriptors: *Oil, *Toxicity, *Feeding rates, *Copepods, Bioassay, Kuwait oil, Animal metabolism, Animal physiology, Plankton, Oil spills, Oil pollution, Mortality, Seasonal, Methodology, *Crude oil, *Dispersants.

Sub-lethal toxicity and recovery tests were made on feeding rates of 4 species of copepods using Kuwait oils kept in suspension on a slowly rotating wheel. Counts of faecal pellets from individuals fed on standard algal suspension were made after 20 h at 12 degrees C. This exposure produced only marginal effects at 1 and 2 ppm, but 10 ppm produced definite effects on planktonic species. Recoveries were generally quite good from

'weathered' oil treatments. Oils emulsified alone did not produce significantly different effects in these experiments from oils emulsified with dispersants. (Deal-EIS)
W80-00666

MEASUREMENT OF COMPLEXING MATERIALS EXCRETED FROM ALGAE AND THEIR ABILITY TO AMELIORATE COPPER TOXICITY,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
C. M. G. Van den Berg, P. T. S. Wong, and Y. K. Chau.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 901-905, 1979. 2 fig, 3 tab, 25 ref.

Descriptors: *Copper, *Toxicity, *Aquatic algae, Phytoplankton, Ions, Metabolism, Chlorella, Scenedesmus, Anabaena, Primary productivity, Chemical reactions, Chemical properties, Tracers, Complexation, Detoxification, *Ligands.

The complexing capacities of three algal exudates and the conditional stability constants of their copper complexes have been determined by an ion exchange method. Their ability to ameliorate copper toxicity towards the primary production of Chlorella vulgaris is related to the conditional stability constants, which regulate the ionic copper concentration. Anabaena cylindrica, Navicula pelliculosa, and Scenedesmus quadricauda excreted 6.73, 2.86, and 0.66 micro mol/L of complexing ligands, respectively, with conditional stability constants of 10 to the 7.7 power, 10 to the 8.1 power, and 10 to the 8.6 power, respectively, for their corresponding copper complexes. When these constants were applied in calculations, a free copper ion concentration of 10 to the minus 10.3 power mol/L was found in each exudate. (Deal-EIS)
W80-00667

OXYGEN DEPLETION AND WINTERKILL RISK IN SMALL PRAIRIE LAKES UNDER EXTENDED ICE COVER,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
J. Barica, and J. A. Mathias.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 980-986, 1979. 7 fig, 3 tab, 12 ref.

Descriptors: *Mathematical models, *Dissolved oxygen, *Ice cover, *Iced lakes, *Winterkilling, Lakes, Eutrophication, Fishkill, Mortality, Water chemistry, Seasonal, Winter, Cold resistance, Oxygen depletion.

Mean rates of dissolved oxygen depletion in 10 shallow eutrophic prairie lakes (area 2.3-27.3 ha, mean depth 1.6-4.2 m), ranged from 0.22 to 0.34 gr/sq m/d for nonstratified lakes and 0.32-0.42 gr/sq m/d for stratified ones. An average rate for all lakes was 0.29 plus or minus 0.06 gr/sq m/d. The rates correlated with the lake depth. A method for estimating the winterkill risk on the basis of initial oxygen storage, rate of dissolved oxygen depletion and/or the mean or maximum lake depth is proposed. (Deal-EIS)
W80-00668

ZINC UPTAKE IN MARINE DIATOMS,
Tokyo Univ. of Fisheries (Japan).
A. Kamatani, M. Takahashi, and Y. Morita.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 6, p 715-719, 1979. 3 fig, 4 tab, 23 ref.

Descriptors: *Zinc, *Absorption, *Diatoms, Toxicity, Phosphates, Phosphorus, Chelation, Heavy metals, Primary productivity, Water chemistry, Chemical analysis, Growth rates, *Bioaccumulation.

Three diatoms, Cyclotella nana, Phaeoductylum tricornutum and Thalassiosira decipiens, were used for estimating the requirement and the toxicity of zinc. For their normal growth the diatoms required zinc at the level of 0.1 microg/l. Thus, the zinc levels in the seawater do not constitute a limiting factor for maintaining the potential primary production level resulting from the estimation with the oceanic phosphate-phosphorus. The zinc toxicity at high concentration was suppressed by the presence of chelator (EDTA). In the case of experiments with EDTA the amount of zinc taken up by diatoms was found to be independent of the ambient zinc concentration, while without EDTA the uptake of zinc varied depending upon the concentration. The minimum requirement of zinc for normal growth per unit-weight of diatom was estimated as 1-3 ppm, and the diatoms, which were harvested from the culture medium with EDTA, accumulated more zinc in their body, by one order of magnitude, than their minimum requirement. (Deal-EIS)
W80-00669

MUTAGENIC ACTIVITY IN ORGANIC WASTEWATER CONCENTRATES,
California Univ., Berkeley. School of Public Health.
S. M. Rappaport, M. G. Richard, M. C. Hollstein, and R. E. Talcott.
Environmental Science and Technology, Vol. 13, No. 8, p 957-961, 1979. 1 fig, 3 tab, 36 ref.

Descriptors: *Bioassay, *Laboratory tests, *Monitoring, *Waste treatment, Methodology, Organic wastes, Pulp and paper industry, Waste disposal, Waste treatment, Waste water disposal, Testing, Testing procedures, Primary waste treatment, Secondary waste treatment, Relative toxicity, *Mutagenicity.

Organic wastewater concentrates from six treatment plants were tested for mutagenicity using the Ames mutagen bioassay. Concentrates were prepared by passing 4-8 L of wastewater through two porous copolymer resins (Amberlite XAD-2 and XAD-7) in series. Of four tester strains, TA-98 in the presence of Arochlor-induced rat liver enzymes was the most sensitive indicator of mutagenicity. Mutagenic responses were observed in extracts from most of the plants tested. More activity was found in secondary and post-secondary extracts than in primary extracts. Dose-response curves obtained for selected samples showed a maximum activity of 210 revertants/mg of extract (TA-98 plus S-9). Fractionation of positive extracts showed the activity to be primarily in the basic and neutral fractions, while acid fractions were relatively inactive. Waste waters treated were domestic, industrial, electronic, cannery and agricultural wastes. (Katz-EIS)
W80-00670

MIXING AN ENCLOSED, 1300 CUBIC METER WATER COLUMN: EFFECTS ON THE PLANKTONIC FOOD WEB,
British Columbia Univ., Vancouver. Inst. of Oceanography.
N. C. Sonntag, and T. R. Parsons.
Journal of Plankton Research, Vol. 1, No. 1, p 85-102, 1979. 5 fig, 5 tab, 25 ref.

Descriptors: *Food webs, *Plankton, *Nutrients, Phytoplankton, Zooplankton, Chum salmon, Copepods, Growth rates, Productivity, Trophic level, Bottom sediments, Mortality, Fish food organisms, *Ctenophores.

The nutrient, phytoplankton, and zooplankton dynamics in three enclosed water columns (1300 cubic meter) are described. Two of the enclosures were mixed using a bubbling chamber at depth. Young chum salmon (Oncorhynchus keta) were added to one of the mixed enclosures and the unmixed enclosure. No other manipulations were imposed. Copepods appeared in large numbers (e.g. especially Pseudocalanus minutus s.l. and Paracalanus parvus) and population growth rates were estimated. Ctenophores did not appear in large numbers despite presumably ideal food environments; it is suggested that in one enclosure this is a consequence of fish predation on the ctenophores. The fish experienced high mortalities and low growth rates presumably due to unsuitable prey size. Weekly collections of sediment permitted isolation of two major sediment contributors, the first from phytoplankton sinking and the second from biogenic fallout associated with herbivore production. It was found that the more oligotrophic enclosure (unmixed) experienced proportionally higher utilization of organic carbon. Some of these results are explained by our data while others require more sophisticated experimentation, both in the design of the containers and in the types of observations. (Deal-EIS)
W80-00672

TOXICITY AND PHARMACOLOGY OF EXTRACTS FROM DORID NUDIBRANCHS,
Stanford Univ., Pacific Grove, CA. Hopkins Marine Station.
F. A. Fuhrman, G. J. Fuhrman, and K. DeRiemer.
Biological Bulletin, Vol. 156, p 289-299, 1979. 1 tab, 3 fig, 40 ref.

Descriptors: *Mollusks, *Nudibranchs, *Toxins, *Mode of action, Chemical analysis, Doriopsilla, Anisodoris, Histamine, Invertebrates, Pharmacology, Analytical techniques, Methodology, Chemical properties.

Dorid nudibranch mollusks rely on a variety of mechanisms to rend themselves undesirable to predators. Toxic substances have been isolated and identified in some species collected from around California. Aqueous extracts of digestive glands of five species of dorid nudibranchs were lethal when injected into shore crabs and when injected intrperitoneally into mice. Though histamine was identified in the extract, the amount present was too small to account for the toxicity of the glands. An active fragment designated 'dorid toxin' was obtained by fractionation. This substance produced lethargy and bradycardia in mice. It has negative inotropic and chronotropic effects on isolated hearts. It is heat stable and resistant to profeases so it is probably not a polypeptide. (D. Katz-EIS)
W80-00673

NEPHROCALCINOSIS IN RAINBOW TROUT SALMO GAIRDNERI RICHARDSON; THE EFFECT OF EXPOSURE TO ELEVATED CO2 CONCENTRATIONS,
Shearwater Fish Farming Carlisle (England).
G. R. Smart, D. Knox, J. G. Harrison, J. A. Ralph, and R. H. Richards.
Journal of Fish Diseases, Vol. 2, p 279-289, 1979. 1 fig, 6 tab, 20 ref.

Descriptors: *Fish diseases, *Rainbow trout, *Carbon dioxide, Bioassay, Animal pathology, Chemical analysis, Fish physiology, Phosphates, Fish diets, Water chemistry, Calcium, Magnesium, Phosphorus, *Tissue analysis, *Kidney.

Rainbow trout exposed to environmental free CO2 concentrations ranging from 12-60 mg/l for a minimum of 275 days developed nephrocalcinosis. Gross histopathological and chemical examinations demonstrated that prevalence and severity of nephrocalcinosis increased with increasing CO2 concentrations. The condition was characterized by calcification and granuloma formation in kidney and stomach. Diet, but not water, PO4-P concentration appeared to modify the prevalence and severity at each CO2 concentration tested. (Deal-EIS)
W80-00674

THE EFFECT OF CADMIUM AND LEAD ON THE GROWTH OF TWO SPECIES OF MARINE PHYTOPLANKTON WITH PARTICULAR REFERENCE TO THE DEVELOPMENT OF TOLERANCE,
Queen Mary Coll., London (England). Dept. of Zoology and Comparative Physiology.
J. R. Jennings.
Journal of Plankton Research, Vol. 1, No. 2, p 121-136, 1979. 6 fig, 2 tab, 37 ref.

Descriptors: *Cadmium, *Lead, *Growth rates, *Toxicity, *Phytoplankton, Bioassay, Salinity, Resistance, Mortality, Heavy metals, Chlorophyta, Chrysophyta, Water chemistry, Marine algae.

Decreases in salinity (<10%) increased the growth rates of Phaeodactylum tricornutum and Dunaliella tertiolecta. Increasing levels of cadmium (1-50 ppm(mg/l)) reduced the growth rates of both species. 100 ppm cadmium was lethal to D. tertiolecta but not to P. tricornutum. Lead (1-4 ppm) initially increased the growth rate of D. tertiolecta but then caused all but the 1 ppm culture to die. Lead (1-4 ppm) caused a decrease in growth rate of P. tricornutum. After exposure to 1 ppm cadmium, cultures of D. tertiolecta showed an increased tolerance to levels of cadmium, and a changed response to levels of lead. Exposure of P. tricornutum to either cadmium or lead, or exposure of D. tertiolecta to lead caused no change in response to either metal. (Deal-EIS)
W80-00676

REDUCTION OF NONIONIC SURFACTANT TOXICITY BY SECONDARY TREATMENT,
Procter and Gamble Co., Cincinnati, OH.
A. W. Maki, A. J. Rubin, R. M. Sykes, and R. L. Shank.
Journal of the Water Pollution Control Federation, Vol. 51, No. 9, p 2301-2313, 1979. 3 fig, 5 tab, 20 ref.

Descriptors: *Surfactants, *Toxicity, *Secondary treatment, Detergents, Biodegradation, Wastewater treatment, Minnows, Water chemistry, Benthic fauna, Activated sludge, Sewage effluents, Sunfishes, Daphnia, Biochemical oxygen demand, Alkyl ethoxylate surfactant.

Field and laboratory studies of biodegradability and toxicity of an alkyl ethoxylate nonionic surfactant were conducted to determine degradability of the surfactant by secondary wastewater treatment and the effects of the effluent on the benthic fauna of the receiving stream. No increase in surfactant levels in plant effluent or stream stations was observed during periods when influent was spiked at 4 and 14 mg/l. The acute toxicity is eliminated by secondary treatment and the degradation products of an initial 30 mg/l concentration are nontoxic to fathead minnows. Significant changes in benthic species composition and density of some macroinvertebrates occurred during the spiking program, but these resulted from the natural seasonal life cycles. (Deal-EIS)
W80-00678

ACUTE TOXICITY OF COPPER, CADMIUM AND ZINC TO THREE SPECIES OF MARINE COPEPOD,
Victoria Ministry for Conservation, Melbourne (Australia). Marine Pollution Studies Group.
G. H. Arnott, and M. Ahsanullah.
Australian Journal of Marine and Freshwater Research, Vol. 30, p 63-71, 1979. 2 tab, 34 ref.

Descriptors: *Lethal limit, *Toxicity, *Copper, *Cadmium, *Zinc, *Copepods, *Methodology, Laboratory tests, Metals, Crustaceans, Laboratory tests, Path of pollutants, Scutellidium, Paracalanus, Acartia, Invertebrates, Plankton, Aquatic animals, Bioindicators.

Acute toxicity tests were carried out with three metals on the marine copepods Scutellidum sp., Paracalanus parvus and Acartia simplex. The resulting 24-h LC50 values showed that copper was the most toxic metal, with cadmium more toxic than zinc for two of the three species. Scutellidium sp. was more sensitive than P. parvus and A. simplex to all metals, LC50 values being 0.18, 0.66 and 1.09 mg/l for copper, cadmium and zinc respective other marine copepods given by other workers. Some experimental problems in conducting toxicity tests with copepods are indicated. Application of the present LC50 data to existing water quality criteria produced unrealistic 'safe' concentrations in the case of copper. Such a finding illustrates the arbitrary nature of application factors and questions the usefulness of acute toxicity tests as the major tool for environmental protection. (D. Katz-EIS)
W80-00679

SURVEY OF DEMERSAL FISH IN PORT PHILLIP BAY FOR INCIDENCE OF NEOPLASIA,
Melbourne Univ. Medical Centre. Parkville (Australia).
G. C. Hard, R. Williams, and J. Lee.
Australian Journal of Marine and Freshwater Research, Vol. 30, p 73-79, 1979. 5 fig, 21 ref.

Descriptors: *Neoplasms, *Fish Diseases, *Pathology, *Demersal fish, *Marine fish, Water pollution effects, Port Phillip Bay(Australia), Industrial wastes, Domestic wastes, Rhombosolea, Ammotrehs, Platycephalus, Atopomycterus, Sphaeroides, Navodon, Scobinichthys, Brachaluteres, Paratrigla, Benthic fauna, Flounders, Benthos, Microscopy, On-site investigations.

A survey aimed at determining the incidence of neoplasms, particularly superficial tumours, in the common demersal fish species in zones of Port Phillip bay exposed to domestic and industrial contamination has been conducted on a monthly basis over a period of 17 months. Trawling at three sampling stations provided sufficient numbers for scrutiny of a range of species. In contrast with the experience overseas of epidermal papillomas in certain species of pleuronectids, the Port Phillip Bay flounder were totally free of skin tumours. Only two true neoplasms were encountered, a neurilemmoma and a lipoma, both of these being from specimens of Platycephalus bassensis. A high incidence of non-neoplastic skin 'tumours' was observed in certain letherjackets (family Balistidae). The essentially negative findings in terms of cancer incidence provides a reference base for any future studies examining disease patterns in faunal populations of Port Phillip Bay. (D. Katz-EIS)
W80-00680

THE ROLE OF MELANO-MACROPHAGE CENTRES IN IRON STORAGE IN NORMAL AND DISEASED FISH,
Stirling Univ. (Scotland). Unit of Aquatic Pathobiology.
C. Agius.
Journal of Fish Diseases, Vol. 2, p 337-343, 1979. 1 fig, 2 tab, 10 ref.

Descriptors: *Fish diseases, *Fish physiology, *Iron, Teleosts, Chemical analysis, Animal metabolism, Proteins, Rainbow trout, Animal pathology, Fish diets, Path of pollutants, Fresh water fish, *Tissue analysis, *Liver, *Spleen, *Kidney.

The spleen, kidney and liver melano-macrophage centres of 14 species of clinically normal teleost fish were examined histochemically for ferric iron. Iron was present in varying amounts within the splenic centres of most specimens, but by contrast it was rarely found in the centres of the kidney and the liver. Under conditions of starvation and in diseased fish, a markedly increased deposition of ferric iron occurred in the splenic centres of nearly all fish examined. By comparison, the iron content in the kidney and liver centres was generally still very low. These results suggest that there exist important functional differences between the pigment centres of different haemopoietic tissues of teleosts. (Deal-EIS)
W80-00683

EFFECTS OF ACID MINE DRAINAGE ON A SOUTHWESTERN PENNSYLVANIA STREAM,
California State Coll., PA. Dept. of Biology.
T. C. Moon, and C. M. Lucostic.
Water, Air and Soil Pollution, Vol. 11, p 377-390, 1979. 10 fig, 1 tab, 41 ref.

Descriptors: *Acid streams, *Mine drainage, *Coal mine wastes, Acidic water, Acid mine water, Mine wastes, Pennsylvania, Coals, Benthic fauna, Invertebrates, Water chemistry, Diptera, Aquatic insects, Dominant organisms, Ecological distribution, *Species diversity.

Physicochemical parameters and benthic macroinvertebrate community structure were studied in a small valley stream in southwestern Pennsylvania. Sampling stations were located upstream and downstream of coal mine drainage input. Due to an alkaline discharge and significant downstream alkalinity the pH below the mine effluent remained between 5.8 and 7.0 throughout the course of this 18 mo. study. The major factor affecting the benthic community seemed to be ferric hydroxide deposition. Certain taxa (Plecoptera and Ephemeroptera) were abundant at station sites above the mine discharge, while only those taxa tolerant of polluted conditions, such as Chironomidae and Tubifex, were prevalent at the downstream station sites. An analysis of benthic populations through changes in total numbers, species diversity, and species indicator organisms graphically demonstrated environmental stress within this aquatic ecosystem. (Deal-EIS)
W80-00684

STUDY OF METAL CONTENTS OF ELASMOBRANCH FISHES: PART I-METAL CONCENTRATION IN THE MUSCLE TISSUES OF A DOGFISH, SQUALUS MITSUKURII,
Tokyo Univ. (Japan). Dept. of Agricultural Chemistry.
M. Taguchi, K. Yasuda, S. Toda, and M. Shimizu.
Marine Environmental Research, Vol. 2, p 239-249, 1979. 4 tab, 4 fig, 21 ref.

Descriptors: *Heavy metals, *Mercury, *Cadmium, *Bioaccumulation, *Sharks, Path of pollutants, Length, Elasmobranchs, Tissue analysis, Metals, Zinc, Iron, Copper, Squalus, Analytical techniques, Dogfish, Marine fish, Embryonic growth stage, Food chains, Trophic levels, Distribution patterns.

Concentrations of Hg, Zn, Fe, Cd and Cu in the muscle tissues of a dogfish, Squalus mitsukurii, were determined by atomic absorption spectrometry and found to be in the ranges of 0.019-2.13, 1.8-3.6, 1.5-5.7, 0.001-0.018 and 0.12-0.70 microgr/gr wet weight, respectively. The frequency distributions of concentrations, with the exception of mercury, were found to be log-normal. The correlation coefficient between mercury content and total length was positive and large and statistically highly significant. For other metals negative correlations were observed. Mercury concentration in the muscle was found to increase in proportion to the total length cubed. Regression of mercury concentration on age of sharks was shown to be linear. Analysis of covariance showed that the difference between sexes was not statistically significant, either in slope or in height. The concentration of mercury in the muscle tissues of embryos was considerably lower, Cd roughly the same and Zn and Fe higher than those of mothers. The concentrations of Zn, Fe and Cu are higher in the embryonic stage and immediately after birth than in later stages of growth. (D. Katz-EIS)
W80-00685

CONCENTRATION AND SOURCES OF FECAL AND ORGANIC POLLUTION IN AN AGRICULTURAL WATERSHED,
Allen County Soil and Water Conservation District, Fort Wayne, IN.
D. R. Dudley, and J. R. Karr.
Water Resources Bulletin, Vol. 15, No. 4, p 911-923, 1979. 2 fig, 6 tab, 17 ref.

Descriptors: *Organic wastes, *Coliforms, *Agricultural wastes, Sewage bacteria, Indiana, Agricultural runoff, Discharge(Water), Biochemical oxygen demand, Public health, Water quality standards, Farm wastes, Septic tanks, Pathogenic bacteria, Streptococcus, Livestock operations.

Fecal contamination and organic pollution of an agricultural drainage in northeast Indiana was high. Bacterial counts (total coliform, TC; fecal coliform, FC; and fecal streptococcus, FS) and biochemical oxygen demand (BOD) were used to assess waste concentrations. Coliform counts indicated that sections of the drainage receiving septic effluent had waste concentrations far in excess of public health standards. Areas of drainage remote from septic tank pollution were found to occasionally meet federal public health standards for whole body contact recreation but generally these areas had twice the allowable limit of 200 FC/100 ml. Bacterial contamination was highest during runoff

events when the median values for TC, FC, and FS were 5, 3, and 17 times greater, respectively, than the median values during low stream discharge. Surface flows carried contaminants from unconfined livestock operations and fecally contaminated sediment was transported by high waters. (Deal-EIS)
W80-00687

SOME OBSERVATIONS ON POLLUTANTS OF VELSAO BAY (GOA),
National Inst. of Oceanography, Goa (India).
M. D. Zingde, S. Y. S. Singbal, and C. V. G. Reddy.
Mahasagar-Bulletin of the National Institute of Oceanography, Vol. 12, No. 2, p 69-74, 1979. 1 fig, 4 tab, 12 ref.

Descriptors: *Fishkill, *Industrial wastes, *Copper, *Zinc, *Manganese, *Iron, *Nickel, Lead, Metals, Fertilizers, Fish physiology, Toxicity, Mortality, Water quality, Ammonia, Nitrates, Nitrites, Phosphates, Water chemistry, *Arsenic, *Tissue analysis.

Results have been reported on As, Cu and Zn in some of the dead fishes collected during the fishkill at Velsao Bay where the effluents from a fertilizer factory were being discharged. The levels were compared with those from unpolluted localities. While the levels of copper and zinc are comparable, arsenic was higher in dead fishes. The observed concentrations, however, do not indicate acute toxicity. The environmental parameters indicate significant changes in the water quality of the Velsao Bay. Trace metals in the oysters of the Velsao Bay were monitored and the observed concentrations of Mn, Fe, Ni, Cu, Zn, As and Pb do not indicate any significant influence of the factory effluents. (Deal-EIS)
W80-00688

SIMULATION MODEL OF THE EVOLUTION OF THE CHEMICAL COMPOSITION OF A MINERAL-SOLUTION SYSTEM AND ITS APPLICATIONS (MODELE DE SIMULATION DE L'EVOLUTION DE LA COMPOSITION CHIMIQUE D'UN SYSTEME MINERAUX-SOLUTION ET SES APPLICATIONS),
Groupement d'Etudes et de Realisations des Societes d'Amenagement Regional, Nimes (France).
M. Dosso, and A. Carriere.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 237-242, 1978. 3 fig.

Descriptors: *Model studies, *Saline soils, *Water quality, *Soil water movement, Mathematical models, Evaporation, Sodium, Calcium, Magnesium, Analytical techniques, Chemical properties, Water properties, Mineral water, Salts, Aqueous solutions, Saturation, Ions, Chemical reactions, Ionization, Adsorption, Sodium adsorption ratio.

The model presented in this paper was based on the thermodynamic relationships which characterize the equilibrium relationships between minerals and solutions. It calculated from the composition of a given water, the distribution of simple and complex ions and the degree of saturation of the solution in relation to a large number of minerals and salts. It simulated the dissolution reactions of one or several minerals as well as the evaporation of the solution. The main application was the construction of a model simulation of saline soils or soils susceptible to becoming saline. (See also W79-00379) (Humphreys-ISWS)
W80-00721

PETROLEUM HYDROCARBONS IN URBAN RUNOFF,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
For primary bibliographic entry see Field 5B.
W80-00730

A MORPHOMETRIC STUDY OF LEAD AND COPPER EFFECTS ON DIATOMA TENUE VAR. ELONGATUM (BACILLARIOPHYTA),
Michigan Univ., Ann Arbor. Great Lakes Research Div.
L. Sicko-Goad, and E. F. Stoermer.
Journal of Phycology, Vol. 15, p 316-321, 1979. 5 fig, 2 tab, 35 ref.

Descriptors: *Lead, *Copper, *Growth rates, *Toxicity, Diatoms, Phosphorus, Cytological studies, Nutrients, Phosphates, Chemical analysis, Electron microscopy, Heavy metals, Path of pollutants, Metabolism.

Polyphosphate bodies containing lead were induced in laboratory cultures of Diatoma tenue var. elongatum Lyngb. by the addition of phosphorus and 0.05 microg-atoms/l Pb to P deficient medium. Morphometric analysis of cells exposed to Pb showed a significant decrease in number of mitochondria with a concomitant increase in their volume and an increase in membranous organelles in the vacuole compared to phosphorus starved and phosphorus sufficient controls. Exposure of cultures to 0.08 microg-atoms/l copper resulted in reduction of the number of polyphosphate bodies formed during luxury uptake but no other significant morphological changes in cellular organelles. Ecological implications of the interactions between nutrients and low level trace metal contamination are discussed. (Deal-EIS)
W80-00782

TEMPERATURE-MONITORING AND SAFETY-CONTROL DEVICE,
Environmental Research Lab.-Duluth, MN.
A. E. Lemke, and W. F. Dawson.
The Progressive Fish Culturist, Vol. 41, No. 3, p 165-166, 1979. 2 fig, 1 tab, 1 ref.

Descriptors: *Research equipment, *Water temperature, *Monitoring, Bioassay, Equipment, Aquaria, Electrical equipment, Automation, Electric switches, Aquiculture, Laboratory equipment.

Experimental work involving poikilothermic animals such as fish and aquatic invertebrates requires close control of temperature. This report describes a solid-state monitoring apparatus that has a variable set point and variable diversion from set point as well as an output to a single alarm system for alerting personnel when diversion occurs. The set point can be varied continuously from 0 to 50 C, and the diversion can be varied from 0.3 to 2.0 C. (Deal-EIS)
W80-00783

COMPARISON OF ANESTHETIC POTENCY OF BENZOCAINE HYDROCHLORIDE AND MS-222 IN TWO FRESHWATER FISH SPECIES,
Randse Afrikaanse Univ., Johannesburg (South Africa). Dept. of Zoology.
J. T. Ferreira, G. L. Smit, H. J. Schoonbee, and C. W. Holzapfel.
The Progressive Fish Culturist, Vol. 21, No. 3, p 161-163, 1979. 1 fig, 1 tab, 8 ref.

Descriptors: *Chemical properties, *Carp, *Tilapia, *Aquiculture, Fish physiology, Freshwater fish, Chemical analysis, Organic compounds, Animal metabolism, Fish management, Analytical techniques, Toxicity, *Anesthetics, *MS-222, *Benzocaine hydrochloride.

The hydrochloride of ethyl p-aminobenzoate was synthesized and its anesthetic potency compared with that of MS-222 at concentrations of 50, 80, and 100 mg/L. The free compound of these agents in fish blood was also determined. The results indicate that benzocaine hydrochloride is a more effective anesthetic than MS-222 at the concentrations applied. It must be pointed out, however, that benzocaine hydrochloride is not registered for fishery use in the United States. (Deal-EIS)
W80-00784

TOXICITY OF FISHERY CHEMICALS TO THE ASIATIC CLAM, CORBICULA MANILENSIS,
Fish and Wildlife Service, Warm Springs, GA. Southeastern Fish Control.
J. H. Chandler, Jr., and L. L. Marking.
The Progressive Fish Culturist, Vol. 41, No. 3, p 148-151, 1979. 2 tab, 12 ref.

Descriptors: *Pesticide toxicity, *Clams, *Pesticides, Fish control agents, Animal physiology, Fouling, Chemical properties, Rotenone, Animal control, *Lampricides, *Disinfectants, *Antimycin, *TFM, *Bayer 73.

The Asiatic clam, a species introduced into U.S. waters, has spread rapidly, and its ability to survive, reproduce, and spread has caused concern. Aquatic biologists suspect that the clams may crowd out indigenous mollusks, and the animals sometimes plug water intake and leave shell deposits that interfere with sand and gravel operations. The toxicity of 20 commonly used fishery chemicals to the Asiatic clam was determined to evaluate hazards to a nontarget aquatic invertebrate and to assess the potential of the chemicals for controlling clam populations. Among six pesticides and two lampricides tested, antimycin was most toxic to the clam; the 96-H LC50 was 0.065 mg/L. Among three therapeutants and two disinfectants tested, nifurpirinol was the most toxic; the 96-h LC50 was 7.60 mg/L. All of the compounds were less toxic to the clam than to fish. As a nontarget organism, this clam would be safe in water treated with any of the tested fishery chemicals at recommended use pattern concentrations. None of the chemicals have potential for controlling unwanted populations of these clams. (Deal-EIS)
W80-00785

CARBONIC ACID ANESTHESIA FOR AQUATIC ORGANISMS,
Colorado State Univ., Fort Collins. Dept. of Fishery and Wildlife Biology.
G. Post.
The Progressive Fish Culturist, vol. 21, No. 3, p 142-144, 1979. 2 fig, 9 ref.

Descriptors: *Fish physiology, *Chemical properties, *Acids, Fish management, Toxicity, Enzymes, Inhibition, Animal metabolism, Fish behavior, Sulfuric acid, Chemical reactions, *Anesthetics, *Carbonic acid.

Carbonic acid in water is a safe, inexpensive, effective, convenient, and easily obtainable anesthetic for fish and other aquatic organisms. Carbonic acid is not a controlled substance in the United States, and may not require U.S. Food and Drug Administration registration. Baths containing 150 to 600 mg/L carbonic acid (H_2CO_3) will anesthetize fish; lower concentrations anesthetize more slowly and less deeply, higher concentrations act more rapidly and with greater sedation. The length of time that fish or aquatic organisms can safely be held in anesthetizing baths depends on the carbonic acid concentration, and is longer at low concentrations than at high concentrations. A convenient procedure for developing known concentrations of carbonic acid in anesthetizing baths involves adding equal volumes of 6.75% (wt/vol) sodium bicarbonate solution and 3.95% (wt/vol) of concentrated (97-98%) sulfuric acid solution to a known volume of water. (Deal-EIS)
W80-00786

MODIFIED VENTURE SUCTION SAMPLER FOR COLLECTING ASIATIC CLAMS,
Oak Ridge National Lab., TN.
J. S. Mattice, and W. Bosworth.
The Progressive Fish Culturist, Vol. 41, No. 3, p 121-123, 1979. 2 fig, 17 ref.

Descriptors: *Research equipment, *Sampling, *Clams, Methodology, On-site data collections, Benthic fauna, Equipment, Pumps, Bottom sampling, Data collections, Asiatic clam.

A device for collecting quantitative samples of the Asiatic clam, Corbicula sp., is described. The sampler is a modified venturi that is normally operated by a diver using scuba. Constriction of the water flow in the sampler supplies a pressure differential, causing water to be sucked in through a side arm.

Water to operate the venturi is supplied by a gasoline-powered pump on a boat, and is conducted to the sampler by a flexible fire hose 7.6 cm (3 in.) in diameter. The sampler is constructed of polyvinylchloride. Suction lifts the substrate and associated clams from a sampling frame placed on the bottom and the main water stream carries the clams through a discharge arm to a mesh collection bag. The sampler is efficient in gravel or rocky substrates, is not depth-limited, is inexpensive and easy to construct, and permits collection of large samples (0.25 sq m). Its use permits the accurate density estimates required for population and community studies. (Deal-EIS)
W80-00787

BIOGEOCHEMISTRY OF SELECTED HEAVY METALS IN WESTERN PORT, VICTORIA, AND USE OF INVERTEBRATES AS INDICATORS WITH EMPHASIS ON MYTILUS EDULIS PLANULATUS,
Victoria Ministry for Conservation, Melbourne (Australia).
J. E. Harris, G. J. Fabris, P. J. Statham, and F. Tawfik.
Australian Journal of Marine and Freshwater Research, Vol. 30, p 159-178, 1979. 4 fig, 7 tab, 36 ref.

Descriptors: *Mussels, *Heavy metals, *Bioindicators, Monitoring, *Cadmium, *Copper, *Iron, *Manganese, *Lead, *Zinc, Sediments, Invertebrates, Geochemistry, Chemical analysis, Industrial wastes, Water chemistry, Swamps, Absorption, *Tissue analysis, Australia, Western Port.

The relationships of Cd, Cu, Fe, Mn, Pb and Zn in sediments, seagrasses, and several invertebrates with geological source areas in the Western Port catchment are examined. Highest concentrations of heavy metals in sediments and seagrasses appear to be derived from an old swamp environment. Highest levels of Cd, Fe, and Pb are found in mussels on the eastern side of the embayment where suspended sediment and detritus from seagrass meadows of the Embayment Head would be carried by the clockwise net circulation in the bay. Zinc distributions are affected by an industrial discharge which has been studied using mussels transplanted from an uncontaminated location. Possible loss of iron and lead from tissues of M. edulis planulatus during freeze-drying was noted and the concentrations of Cd, Cu, Mn, Zn and water content were found to be linear functions of mussel length. The highest levels of cadmium in M. edulis planulatus are found along the non-industrialized eastern side of the embayment. Problems in comparing heavy metal levels in mussels from different areas are discussed. (Deal-EIS)
W80-00788

UPTAKE OF CADMIUM BY THE EELGRASS ZOSTERA MARINA,
Adelphi Univ., Garden City, NY. Dept. of Biology.
W. E. Faraday, and A. C. Churchill.
Marine Biology, Vol. 53, p 293-298, 1979. 2 fig, 1 tab, 25 ref.

Descriptors: *Cadmium, *Absorption, *Plant physiology, Rhizomes, Root systems, Heavy metals, Path of pollutants, Chemical analysis, Aquatic plants, Sediments, *Eelgrass, *Zostera, *Bioaccumulation, *Tissue analysis.

The uptake of cadmium by the shoots of Zostera marina L. (eelgrass) was examined in the laboratory. Experiments were carried out in experimental chambers which allowed the separation of the leaves from the root-rhizome portions of intact shoots. Cadmium uptake by the root-rhizome portions over 24 h was directly related to substrate cadmium concentration (1.0, 5.0 and 10.0 micrograms Cd/ml) and varied from 6.5 to 30.0 micrograms Cd/ml. Cadmium uptake by the root-rhizomes and the leaves in a substrate concentration of 1 micrograms Cd/ml was also related to exposure times (24, 48 and 72 h). Maximum uptake by the root-rhizomes and the leaves was observed after 72 h at a substrate concentration of 1 micrograms Cd/ml and was equivalent to 48 and 94 micrograms Cd/ml, respectively. Translocation of cadmium from the leaves to the root-rhizomes was observed after 24 h, and at the end of 72 h was equivalent to 27% of the total leaf uptake. No cadmium movement from the root-rhizomes to the leaves was detected. (Deal-EIS)
W80-00789

INTERACTIVE EFFECTS OF SALINITY, TEMPERATURE AND POLYCYCLIC AROMATIC HYDROCARBONS ON THE SURVIVAL AND DEVELOPMENT RATE OF LARVAE OF THE MUD CRAB RHITHROPANOPEUS HARRISII,
Texas A and M Univ., College Station. Dept. of Biology.
R. B. Laughlin, Jr., and J. M. Neff.
Marine Biology, Vol. 53, p 281-291, 1979. 8 fig, 6 tab, 44 ref.

Descriptors: *Growth rates, *Crabs, *Aromatic compounds, *Toxicity, Oil, Oil spills, Animal physiology, Growth stages, Salinity, Water temperature, Mortality, Larval growth stage, Bioassay, *Naphthalene, *Metamorphosis, Polyaromatic hydrocarbons, Phenanthrene.

Zoeae of the mud crab Rhithropanopeus harrisii (Gould) were exposed continuously throughout larval development to factorial combinations of salinity, temperature and specific aromatic hydrocarbon concentrations. Salinities and temperatures were 5, 15, or 25 ppt and 20, 25, or 30C, respectively. Either phenanthrene or naphthalene was tested separately at respective concentrations of 0, 100, 150 or 200 ppb and 0, 125, 250 or 500 ppb. Phenanthrene was much more toxic than naphthalene. Naphthalene was not acutely toxic at any physical factor combination-naphthalene concentration tested. Both compounds caused the highest mortality at low salinities. The time course of mortality due to phenanthrene exposure showed that ecdysis between the first and second zoel stage was the most sensitive period for the larvae exposed to aqueous hydrocarbons. Phenanthrene-exposed larvae had a decreased development rate, but the naphthalene-exposed larvae developed faster than the controls. (Deal-EIS)
W80-00790

THE ROCK OYSTER SACCOSTREA GLOMERATA AS AN INDICATOR OF TRACE METALS IN HONG KONG,
Fisheries Research Station, Aberdeen (Hong Kong).
D. J. H. Phillips.
Marine Biology, Vol. 53, p 353-360, 1979. 2 fig, 4 tab, 27 ref.

Descriptors: *Bioindicators, *Oysters, *Trace elements, Metals, Heavy metals, *Cadmium, *Copper, *Iron, *Zinc, Chemical analysis, Monitoring, Water quality, Industrial wastes, Chemical wastes, Domestic wastes, Animal metabolism, *Tissue analysis, *Bioaccumulation.

An urgent need for a sub-tropical and tropical indicator organism for use in the biological monitoring of pollutants is recognised. To this end, preliminary studies have been undertaken to test the indicator ability of the rock oyster for monitoring the trace metals cadmium, copper, iron and zinc. A survey of these trace metals in rock oysters from 54 sites in Hong Kong waters revealed elevated levels of metals in several areas. Profiles of metal abundance in S. glomerata agreed substantially with the distribution of industrial and domestic discharges in Hong Kong, and also with patterns of contamination found in studies of the Pacific oyster Crassostrea gigas and of sediments. Application of statistical analysis to these data has confirmed the relationship between known areas of contamination and elevated metal levels in S. glomerata. This oyster, which exhibits an unusually great capacity to accumulate a range of elements from the ambient environment, thus appears to be a reliable indicator organism, and may be of great value in global monitoring studies. (Deal-EIS)
W80-00793

THE USE OF CHIRONOMID PUPAL EXUVIAE IN THE SURVEILLANCE OF SEWAGE POLLUTION WITHIN A DRAINAGE SYSTEM,
Bristol Univ. (England). Dept. of Zoology.
J. D. McGill, R. S. Wilson, and A. M. Brake.
Water Research, Vol. 13, p 887-894, 1979. 7 fig, 2 tab, 22 ref.

Descriptors: *Sewage effluents, *Toxicity, *Diptera, *Bioindicators, Dominant organisms, Monitoring, Growth stages, Sewage treatment, Biochemical, Oxygen demand, Suspended solids, Ammonia, Water quality, Water chemistry, Aquatic insects, Seasonal.

Collections of chironomid pupal exuviae were made during the summers of 1976 and 1977 above and below a number of sewage effluent discharges in the Bristol R. Avon drainage system. It was found that the exuvial collections showed changes in their species composition and relative species abundance which matched the overall polluting effects of the various discharges, the most change occurring below effluents of poor quality discharging into small rivers. The pollutional effects were more marked during 1976 when the rivers had unusually low flow, than in 1977 when the river flows were higher. It is concluded that biological changes consequent on sewage effluent discharge into these rivers can be monitored by sampling the chironomid pupal exuviae above and below the site of discharge. (Deal-EIS)
W80-00794

CHRONIC TOXICITY OF VANADIUM TO FLAGFISH,
Guelph Univ. (Ontario). Dept. of Zoology.
D. A. Holdway, and J. B. Sprague.
Water Research, Vol. 13, p 905-910, 1979. 3 tab, 19 ref.

Descriptors: *Toxicity, *Metals, Bioassay, Mortality, Growth rates, Larval growth stage, Fish reproduction, Fish physiology, Fry, Chemical analysis, Fecundity, *Flagfish, *Jordanella, *Vanadium, *Bioaccumulation, *Tissue analysis.

The 96-h LC50 of vanadium to adult American flagfish (Jordanella floridae) was 11.2 mg/l in very hard water. Larvae showed 28-day LC50's of 1.13 and 1.88 mg/l of vanadium with larger larvae being more resistant. These appeared to be thresholds of lethality. During continuous exposure for 96 days, larval growth and survival were the most sensitive indicators of vanadium toxicity and were marginally reduced at 0.17 mg/l. At 0.041 mg/l, there were no deleterious sublethal effects but there was definite stimulation of growth in females and of reproductive performance. The threshold for chronic toxicity was judged to be about 0.08 mg/l. The 'safe'-to-lethal ratio was 0.007 and this could be used as an application factor for other species. There was no clear evidence that vanadium had any long-term cumulative toxicity. (Deal-EIS)
W80-00795

SURVEY OF THE POLLUTION IN A COASTAL AREA OF THE TYRRHENIAN SEA. AERIAL PHOTOGRAPHY, PHYSICO-CHEMICAL AND MICROBIOLOGICAL INVESTIGATIONS AND MUTAGENIC MONITORING,
Genoa Univ. (Italy). Inst. of Hygiene.
F. L. Petrilli, G. P. De Renzi, R. P. Morelli, and S. De Flora.
Water Research, Vol. 13, p 895-904, 1979. 4 tab, 20 ref.

Descriptors: *Industrial wastes, *Water quality, *Pathogenic bacteria, Water pollution effects, Chemical wastes, Path of pollutants, Domestic wastes, Sewage effluents, Coasts, Water chemistry, Aerial photography, Remote sensing, E. Coli, Streptococcus, Viruses, Monitoring, *Mutagens.

Investigations were carried out in a coastal area of the Tyrrhenian Sea, which receives wastes from a chemical manufacturing industry. Industrial wastes are combined with domestic sewage prior to discharge into the sea. Warm and alkaline wastewaters carry large amounts of whitish suspended solids, mainly composed of calcium carbonate, calcium sulphate and magnesium hydroxide, which are responsible for an evident visual

pollution of the sandy shore and of the facing seawater body. Alterations of physical parameters (temperature and pH values) were found to affect the investigated coastal area only to a limited extent. Conversely, aerial photographic investigations afforded a more complete picture of pollution spreading. Infrared and chiefly water-penetration images provided information on the underwater environment, and the resulting findings could be correlated with the particle size analysis of sediment samples. Faecal streptococci represented a considerable proportion of total heterotrophic bacteria in waste and sea-water, whereas concentration of total and faecal coliforms was relatively low. These figures suggested a possible selective inactivation of bacteria in industrial waters, which was supported by the findings of survival tests with three bacterial species (E. coli, Strep. faecalis and S. typhi). Survival of a virus (type 1 poliovirus) and of a virus antigen (hepatitis B surface antigen or HBsAg) was also investigated under various conditions. (Deal-EIS)
W80-00796

THE TEMPERATURE PREFERENCE OF THE THREE-SPINED STICKLEBACK, GASTEROSTEUS ACULEATUS L. (PISCES), COLLECTED AT DIFFERENT SEASONS,
Oslo Univ. (Norway). Inst. for Marine Biology.
K. H. Roed.
Sarsia, Vol. 64, p 137-141, 1979. 3 fig, 1 tab, 17 ref.

Descriptors: *Water temperature, *Fish behavior, *Seasonal, *Sticklebacks, Thermal stratification, Fish physiology, Fish genetics, Aquatic environment, Salinity, Vertical migration, *Acclimation.

Thermal preferences were determined, at different seasons, in an aquarium with stable vertical gradients. The temperature preference was found similar for fish collected in April, June, August, and October, despite different acclimation temperatures and length of acclimation period. Both 0-group and 1-group or older fish chose temperatures less than 11C, and in most cases preferred temperatures between 4 and 8C, which was lower than the in situ temperatures most of the year. The results suggest that the temperature preference of stickleback from Oslofjorden may be genetically determined. (Deal-EIS)
W80-00797

TOXIC EFFECTS OF AQUEOUS EXTRACTS OF EKOFISK CRUDE OIL, CRUDE OIL FRACTIONS, AND COMMERCIAL OIL PRODUCTS ON THE DEVELOPMENT OF SEA URCHIN EGGS,
Tromoe Univ. (Norway). Inst. of Biology and Geology.
I-B. Falk-Petersen.
Sarsia, Vol. 64, p 161-169, 1979. 14 fig, 1 tab, 16 ref.

Descriptors: *Oil, *Toxicity, *Animal growth, Embryonic growth stage, Growth stages, Electron microscopy, Water chemistry, Oil pollution, Mode of action, Sea water, Aromatic compounds, Fuels, *Sea urchins, *Crude oil, *Tissue analysis, *Bioaccumulation.

Embryos of two sea urchin species, Strongylocentrotus droebachiensis and S. pallidus, were studied. Effects were observed directly under the light microscope, and indirectly by electron microscopical investigations (TEM & SEM). Ekofisk crude oil extract had a moderate effect during early development, but affected the embryos strongly during differentiation. BP-gasoline and Kerosine extracts caused effects at rather high total hydrocarbon concentrations, whereas Gas oils, Residue and particularly BP Fuel oil No. 6 extracts were more toxic. TEM-studies revealed an increasing aggregation of electron-dense, lipid-like granules in the cells of affected larvae, SEM-studies did not show differences in surface ultra-structure. (Deal-EIS)
W80-00798

LEAD AND MERCURY IN LESSER SNOW GEESE WINTERING IN LOUISIANA,
Fish and Wildlife Service, Jena, LA. Catahoula National Wildlife Refuge.
L. D. West, and J. D. Newsom.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol. 31, p 180-187, 1977. 2 fig, 3 tab, 28 ref.

Descriptors: *Lead, *Mercury, *Snow Goose, Louisiana, Seasonal, Food habits, Habitats, Hunting, Heavy metals, Chemical analysis, Soil types, Marshes, Migratory birds, *Tissue analysis.

Wintering Lesser Snow Geese (Chen caerulescens) were analyzed for lead and mercury residues and lead shot ingestion. Lead shot ingestion paralleled assimilation of lead residues. Snow geese collected in rice-growing areas had significantly ($P<0.01$) more lead residues than marsh area geese. This was attributed to different soil firmness, feeding habits, and hunting practices in the 2 areas. Recent deposits of lead apparently played a major role in lead shot ingestion because lead residues and shot ingestion were greatest during the hunting season. Mercury residues significantly ($P<0.05$) declined over the wintering season. (Deal-EIS)
W80-00799

5B. Sources Of Pollution

DETERIORATION OF WATER QUALITY DUE TO LONG RANGE TRANSPORT OF AIR POLLUTION,
For primary bibliographic entry see Field 5G.
W80-00458

GROUND-WATER MANAGEMENT TECHNIQUES FOR THE CONTROL OF SALT-WATER ENCROACHMENT IN GULF-COAST AQUIFERS, A SUMMARY REPORT,
Geological Survey of Alabama, Montgomery.
For primary bibliographic entry see Field 2F.
W80-00490

THE EFFECT OF INTENSE FERTILIZATION ON MIGRATION OF NITROGEN COMPOUNDS IN SOIL,
Technical Univ. of Warsaw (Poland). Dept. of Sanitary Environmental Engineering.
For primary bibliographic entry see Field 5C.
W80-00508

URBAN STORMWATER POLLUTION: AN INVESTIGATION OF THE PROBLEM AND ITS CONTROL,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
R. A. Jeung.
Discussions in Environmental Health Planning, January 1978. 211 p, 43 fig, 26 tab, 93 ref.

Descriptors: *Water quality management(Applied), *Water quantity management, *Stormwater runoff, *Sewer systems, *Erosion control, *Sedimentation control, *Management strategies, Non-point source pollution, Water pollution, Water pollution sources, Erosion, Sediment, Urban runoff, Surface runoff, Infiltration, Agricultural runoff, Slopes, Federal Water Pollution Control Act of 1972, Control measures, Implementation strategies, Waste treatment, Municipal water, Sewers, Drainage systems, Soil loss.

The purpose is to identify pollution caused by stormwater runoff and to make local communities aware of this phenomenon. An extensive literature review is undertaken to examine the origin, transport and effects of contaminants that pollute stormwater runoff. Principal sources include heated water from power plants, silt and pesticides from agriculture, mining acid, industrial chemicals and toxins, and municipal wastes. Erosion and sedimentation processes are described and their adverse effects are presented. Urbanization has increased the problem; sediment is identified as the greatest contributor, by volume, to water pollution. Pollution of receiving waters by runoff is significant, in some cases equivalent to or worse than effluent from secondary treatment plants. Urban sources contribute a smaller though equally potent volume of runoff as rural sources. Recommended measures to relieve sewer system runoff load include installation of seepage pits, dutch drains, porous pavements, and a large storage container within the present sewer system. Recommended erosion/sedimentation control measures include more thorough design review of proposed projects and development, vegetative measures such as seeding and use of chemical soil binders, better use of diversion measures such as drains, and better fine-grained sediment control. Land use controls and management strategies are presented. Erosion measures will be most effective at the preliminary site planning phase of a project. Integration of all water quality, solid waste management and land development programs is essential for effective stormwater runoff management strategies to be implemented. (Arnold-NC)
W80-00525

LONG-TERM EFFECTS OF LAND APPLICATION OF DOMESTIC WASTEWATER: VINELAND, NEW JERSEY, RAPID INFILTRATION SITE,
Benham-Blair and Affiliates, Inc., Oklahoma City, OK.
For primary bibliographic entry see Field 5E.
W80-00529

CASING AND LEAK DEPTHS, AND SOLUTE TRAVEL TIMES TO WELLS,
Iowa State Univ., Ames. Dept. of Agronomy.
A. Battikhi, and D. Kirkham.
Water Resources Bulletin, Vol. 15, No. 4, p 1004-1015, August 1979. 2 fig, 1 tab, 13 ref, 1 append. NSF ENG 75-19394.

Descriptors: *Wells, *Leakage, *Well casings, *Travel time, *Water pollution, *Mathematical models, Model studies, Equations, Depth, Solutes, Theoretical analysis, Well screens, Flow nets, Discharge(Water), Laboratory tests, Well radius.

A mathematical solution based on porous media flow was developed for solute travel time to a well as affected by a leak around the upper part of the casing. Consider a well of radius 0.2 meters (m) penetrating, fully, a semiconfined aquifer of thickness 6 m with impermeable casing length of 4.5 m, and screened casing length 1.5 m. Around the upper 1.5 m of the impermeable casing length, there is a highly permeable region (a leak). The radius of influence of the well is 10 m. The porous flow medium has a hydraulic conductivity of 10 m/day and a porosity of 0.25. Between the water table and the water level in the well, there is a steady state, pumped down head difference of 0.3 m. Solute travel time from a point at the bottom of the leak to the well is 2.33 days. If the leak is sealed (grouted), the travel time is 6.24 days. Examples of 6 different geometries were given. Laboratory studies verified the theory. The computations should be useful in the design and protection of water wells from solutes such as from agriculture, industry, strip mines, or sanitary landfills. (Visocky-ISWS)
W80-00579

PERSISTENCE OF CHLORINE IN COOLING WATER FROM ELECTRIC GENERATING STATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W80-00581

TRANSPORT OF VIRUSES THROUGH ORGANIC SOILS AND SEDIMENTS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Scineces.
For primary bibliographic entry see Field 5E.
W80-00584

DYE-VECTOR FLOW VISUALIZATION--COOLING WATER MODEL,
State Univ. of New York at Buffalo. Dept. of Civil

Engineering.
For primary bibliographic entry see Field 8B.
W80-00586

RATE CONTROLLING PROCESSES IN THE RELEASE OF RADIUM-226 FROM URANIUM MILL TAILINGS, I. LEACHING STUDY,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
J. S. Nathwani, and C. R. Phillips.
Water, Air, and Soil Pollution, Vol. 11, No. 3, p 301-308, April 1979. 2 fig, 2 tab, 16 ref.

Descriptors: *Leaching, *Radium radioisotopes, *Mine wastes, Laboratory tests, Sampling, Water pollution, Water pollution sources, Pollutants, Path of pollutants, Soils, Particle size, Weathering, Uranium radioisotopes, Mill tailings.

Uranium mill tailings (a pyritic quartz conglomerate ore) obtained from a Canadian operation were leached according to a modification of the method recommended by I.A.E.A. for the leaching of radioactive ions from solidified wastes. A static leach test procedure was chosen to provide information to permit an assessment of hazard due to release of Ra-226 to the environment. Narrow range size fractions (53 to 75 um) of both fresh material obtained directly from a tailings line and material weathered for approximately 10 to 15 yr in a tailing basin were leached for up to 70 days. Distilled water and an acidic synthetic effluent (pH 2.5) were chosen as leachants. Two sequential desorption processes were observed, one before and the other after a leaching period of approximately 10 to 15 days. In the later and more significant stage of desorption, the leaching behavior could be described in terms of a diffusion mechanism. Significantly greater quantities of Ra-226 were leached over relatively short leaching periods by the acidic effluent; thus, the quality of the effluent and percolating water in a tailings disposal area would markedly affect the leachability of Ra from tailings. It was also found that the quantities of Ra-226 leached were significantly influenced by the solid:liquid ratio at low leaching volumes. (Sims-ISWS)
W80-00600

RATE CONTROLLING PROCESSES IN THE RELEASE OF RADIUM-226 FROM URANIUM MILL TAILINGS, II. KINETIC STUDY,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
J. S. Nathwani, and C. R. Phillips.
Water, Air, and Soil Pollution, Vol. 11, No. 3, p 309-317, April 1979. 2 fig, 3 tab, 11 ref.

Descriptors: *Kinetics, *Radium radioisotopes, *Mine wastes, Laboratory tests, Sampling, Pollutants, Path of pollutants, Soils, Particle size, Weathering, Water pollution, Water pollution sources, Uranium radioisotopes, Mill tailings, Desorption.

A kinetic study to examine the leaching mechanisms and the rate controlling steps in the release of Ra from loose granular U mill tailings was undertaken. A batch procedure was chosen in which the kinetics of desorption of Ra-226 from tailings were determined by observing the increase in radioactivity in the solution with time. Intraparticle diffusion was found to be the rate controlling step for desorption periods more than 84 h; for leaching periods less than this, the desorption rate was described by a semi-logarithmic relationship involving either film diffusion or a chemical exchange mechanism as the rate controlling step. It was postulated that the intraparticle diffusion constant, B, correlates and defines the internal structure and hence the binding properties of Ra-226 within the tailings aggregate. Values of the intraparticle diffusion coefficient, D sub p, have been calculated, and the effect of pH on D sub p was studied. It was found that the diffusion coefficient at a specific pH does not significantly differ from 'fresh' or 'weathered' samples. However, a minimum value of D sub p was obtained at a pH of about 7.6. Values of D sub p were found to range from 2.5 X 10 to the minus 13th power to 20.0 X 10 to the minus 13th power sq cm/h. (Sims-ISWS)
W80-00601

DEGRADATION OF SELECTED POLYCYCLIC AROMATIC HYDROCARBONS IN COASTAL SEDIMENTS: IMPORTANCE OF MICROBES AND POLYCHAETE WORMS,
Skidaway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 5A.
W80-00613

POLYCHLORINATED BIPHENYLS AND CHLORINATED PESTICIDES IN SOILS OF THE EVERGLADES NATIONAL PARK AND ADJACENT AGRICULTURAL AREAS,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 5A.
W80-00618

CHEMICAL SEEPAGE FROM A TAIL WATER RECOVERY PIT TO ADJACENT GROUND WATER,
Nebraska Univ., Lincoln. Inst. of Agricultural and Natural Resources.
R. F. Spalding, M. E. Exner, J. J. Sullivan , and P. A. Lyon.
Journal of Environmental Quality, Vol 8, No 3, p 374-383, July-September 1979. 7 fig, 1 tab, 17 ref.

Descriptors: *Irrigation, *Water reuse, *Seepage, Nitrogen compounds, Nitrates, Groundwater, Water pollution, Water pollution sources, Tracers, Chemicals, Chemical analysis, Sampling, Soils, Soil water, Infiltration, Agriculture, Reuse pits.

Water samples from 10 tail water recovery (reuse) pits and 18 irrigation wells were analyzed for nitrate-nitrogen (N03-N) and atrazine to ascertain concentrations of these heavily utilized products in surface runoff of irrigation water and groundwater beneath irrigated land in Merrick County, Nebraska. Atrazine concentrations in the reuse pit samples ranged from 1.02 to 23.1 micrograms/liter, and in the groundwater samples concentrations ranged from less than 0.005 to 6.96 micrograms/liter. The significant correlation (r = +0.48) between N03-N and atrazine in the groundwater samples indicated that atrazine probably enters the groundwater by infiltrating the soil. Tracers study results indicated that seepage from reuse pits during late spring and early summer can increase the concentration of both N03-N and atrazine in groundwater. However, throughout the remainder of the year, when water in the reuse pits generally contains much less N03-N and atrazine, seepage generally dilutes already contaminated groundwater. (Sims-ISWS)
W80-00621

SEDIMENT AND NUTRIENT YIELD FROM RESIDENTIAL CONSTRUCTION SITES,
Wisconsin Univ., Madison. Dept. of Soil Science.
T. C. Daniel, P. E. McGuire, D. Stoffel, and B. Miller.
39-01.

Descriptors: *Runoff, *Sediments, *Nutrients, *Construction, Suspended solids, Phosphorus, Nitrogen, Nitrogen compounds, Nitrates, Nitrites, Water pollution, Water pollution sources, Path of pollutants, Water quality, Land use, Monitoring, Nonpoint pollution.

Runoff from three residential construction site watersheds in southeastern Wisconsin was monitored for a 2-year period. Automatic water quality monitoring equipment was established which sampled each event proportional to flow. Loading rates for sediment and nutrients were developed on an event basis and summed to produce annual loads. Average sediment yield for the three single land use watersheds was 19.2 metric tons/ha per year. Concentrations of 60,000 mg/liter SS were observed for major events; 15,000 to 20,000 mg/liter were common for moderate events. Yields of contaminants from residential construction sites are inherently variable and site dependent. Strict extrapolation or comparison of results to other areas or existing literature values is difficult. However, when compared to runoff data from a simultaneous agricultural watershed investigation, the yield of contaminants from construction sites is considerably higher (19.2 vs. less than 1 metric ton/ha per year of sediment). (Sims-ISWS)
W80-00622

A WATER QUALITY STUDY OF A STRETCH OF THE RIVER TIGRIS,
Mosul Univ. (Iraq). Coll. of Engineering.
For primary bibliographic entry see Field 5A.
W80-00623

UPWELLING AND ESTUARY FLUSHING,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W80-00632

A HISTORY OF MERCURY LEVELS IN SWEDISH FAUNA,
Naturhistoriska Riksmuseet, Stockholm (Sweden). Section for Invertebrate Zoology.
For primary bibliographic entry see Field 5A.
W80-00649

THE RESPONSE OF COHO SALMON AND GUPPIES TO 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD) IN WATER,
Pacific Northwest Forest and Range Experiment Station, Corvallis, OR. Forestry Sciences Lab.
For primary bibliographic entry see Field 5A.
W80-00651

TOTAL AND METHYLMERCURY LEVELS IN THREE SPECIES OF WHELKS,
Shimonoseki Univ. of Fisheries (Japan). Dept. of Food Science and Technology.
For primary bibliographic entry see Field 5A.
W80-00656

TRACE METALS IN SEADUCKS OF THE FRASER RIVER DELTA INTERTIDAL AREA, BRITISH COLUMBIA,
Canadian Wildlife Service, Delta (British Columbia).
For primary bibliographic entry see Field 5A.
W80-00657

THE CONCENTRATION AND SPECIATION OF ARSENIC IN MARINE MACRO-ALGAE,
Skidway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 5A.
W80-00658

THE SOURCE OF MUDDY ODOR IN BREAM (ABRAMIS BRAMA) FROM THE PORVOO SEA AREA (GULF OF FINLAND),
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5A.
W80-00661

EFFECTS OF ORAL ADMINISTRATION OF CADMIUM ON FISH-V EFFECTS ON CALCIUM AND INORGANIC PHOSPHORUS EXCRETION IN THE CARP,
Kyushu Univ., Fukuoka (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 5A.
W80-00663

UPTAKE, BINDING AND CLEARANCE OF DIVALENT CADMIUM IN GLYCERA DIBRANCHIATA (ANNELIDA: POLYCHAETA),
San Francisco Univ., CA. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-00664

BODY BURDEN OF CHROMIUM, COPPER, CADMIUM AND LEAD IN THE NEUSTONIC COPEPOD ANOMALOCERA PATERSONI (PONTELLIDAE) COLLECTED FROM THE MEDITERRANEAN SEA,

International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5A.
W80-00665

ZINC UPTAKE IN MARINE DIATOMS,
Tokyo Univ. of Fisheries (Japan).
For primary bibliographic entry see Field 5A.
W80-00669

MUTAGENIC ACTIVITY IN ORGANIC WASTEWATER CONCENTRATES,
California Univ., Berkeley. School of Public Health.
For primary bibliographic entry see Field 5A.
W80-00670

PHOTOOXIDATION PRODUCTS OF A FUEL OIL AND THEIR ANTIMICROBIAL ACTIVITY,
Academy of National Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
R. A. Larson, T. L. Bott, L. L. Hunt, and K. Rogenmuser.
Environmental Science and Technology, Vol. 13, No. 8, p 965-969, 1979. 4 fig, 3 tab, 24 ref.

Descriptors: *Oil, *Oil spill, *Toxicity, Bioassay, Laboratory test, Yeast, Fungi, Algae, Filamentous algae, Fuel oil, Waste treatment, Decomposing organic matter, Phenols, Hydroperoxides, Photooxidation products, *Tetralin hyperoxide, Vaucheria, Antialgal activity, Photosynthesis.

Photooxidation products of a no. 2 fuel oil were fractionated and examined by gas chromatography mass spectrometry. Among the compound types identified were hydroperoxides (alkylated derivatives of tetralin hydroperoxide), phenolic compounds (highly alkylated phenols and tetrahydronaphthols), and carboxylic acids (substituted benzoic and naphthoic acids). Oil fractions and pure compounds characteristic of the photooxidation products were tested for toxicity to a yeast and several filamentous algae. The species tested varied in their tolerance toward the photoproducts, but hydroperoxides generally showed the highest toxicity; tetralin hydroperoxide, at .00003M, significantly reduced yeast growth. Carboxylic acids had less activity and phenolics were still less active. Tetralin hydroperoxide, at concentrations greater than .00008M, reduced photosynthetic carbon fixation by Vaucheria and increased excretion of fixed carbon. (Katz-EIS)
W80-00671

NEPHROCALCINOSIS IN RAINBOW TROUT SALMO GAIRDNERI RICHARDSON; THE EFFECT OF EXPOSURE TO ELEVATED CO2 CONCENTRATIONS,
Shearwater Fish Farming Carlisle (England).
For primary bibliographic entry see Field 5A.
W80-00674

HEPATOMAS IN ATLANTIC TOMCOD MICROGADUS TOMCOD (WALBAUM) COLLECTED IN THE HUDSON RIVER ESTUARY IN NEW YORK,
Fish and Wildlife Service, Bozeman MT. Fish Cultural Development.
C. E. Smith, T. H. Peck, R. J. Klauda, and J. B. McLaren.
Journal of Fish Diseases, Vol. 2, p 313-319, 1979. 4 fig, 14 ref.

Descriptors: *Fish disease, *Polychlorinated biphenyls, Animal pathology, Fish physiology, Hudson River, Fish populations, Spawning, Powerplants, Industrial wastes, Mode of action, *Atlantic tomcod, *Neoplasms, *Tissue analysis, *Liver, Hepatoma.

Incidental observations of Atlantic tomcod during routine laboratory processing revealed that a portion of the adult population collected during the 1977-78 spawning season had enlarged livers containing dark coloured tumours and other abnormalities. Of the total of 264 livers collected between 16 January and 27 February 1978 and grossly examined for prevalence of abnormalities, 25% appeared to contain neoplastic nodules and hepatocellular carcinoma. One liver contained a massive tumour (7 x 12 mm) that involved approximately 60% of the liver. The exact causes of the high prevalence of hepatocellular carcinoma are unknown but polychlorinated biphenyls (PCBs) are suspected of having a possible role. The Hudson River is known to contain elevated concentrations of PCBs. Twelve tomcod livers from the 1977-78 spawning population representing both normal and hepatoma conditions contained concentrations of PCBs ranging from 10.9 to 98.2 ppm (mean of 37.5 ppm). (Deal-EIS)
W80-00675

EFFECTS OF TREATED EFFLUENT ON A NATURAL MARSH,
Canada Centre for Inland Waters, Burlington (Ontario).
A. Mudroch, and J. A. Capobianco.
Journal of the Water Pollution Control Federation, Vol. 51, No. 9, p 2243-2256, 1979. 13 fig, 6 tab, 44 ref.

Descriptors: *Nutrients, *Sewage effluents, *Marshes, Marsh plants, Freshwater marshes, Metals, Nitrogen, Phosphorus, Lead, Chromium, Zinc, Dominant organisms, Plant groupings, Wastewater treatment, Water chemistry, Municipal wastes, Bottom sediments, *Glyceria.

Long-term effects of poor-quality wastewater treatment plant effluent on a natural marsh on the western shore of Lake Ontario were studied. The major contributor of N and P to the marsh area was the treatment plant discharge. Metal concentrations in the water were generally low (.001 to .090 mg/l). Increased concentrations of Pb, Cr, Zn, N, P, and organic C (up to 300 microgram/g, 90 microgram/g, 210 microgram/g, 2.34%, 1.10%, and 0.87% of sediment dry weight, respectively) were found in the sediment vertical profile obtained from the marsh area. The shoot standing crop of the dominant plant species (Glyceria grandis) was associated with amounts of P, N, and organic C in the sediments. (Deal-EIS)
W80-00677

THE EFFECT OF ZINC ON THE INCREASE IN LENGTH OF FIVE SPECIES OF INTERTIDAL FUCALES,
Trondheim Univ. (Norway).
T. Stromgren.
Journal of Experimental Marine Biology and Ecology, Vol. 40, p 95-102, 1979. 4 fig, 19 ref.

Descriptors: *Zinc, *Toxicity, *Growth rates, *Phaeophyta, Length, Size, Plant physiology, Metals, Water chemistry, Water quality, Metabolism, Marine algae, Fucus, Ascophyllum.

The growth rate of Pelvetia canaliculata, Fucus spiralis, F. vesiculosus, F. serratus, and Ascophyllum nodosum was measured in six different concentrations of zinc (0.025 14mg/1) during a period of ten days. No significant growth response was observed at 0.1 mg/1 of zinc. A significant reduction of growth during the first two to three days of exposure to 1.4 mg/1 or more was followed by no or small further decline. Apices of A. nodosum from localities with different background load of zinc (0.1-0.5 mg/1 and $<$ 0.01 mg/1) showed no difference in response to 2.6 mg/1 of zinc. (Deal-EIS)
W80-00682

THE ROLE OF MELANO-MACROPHAGE CENTRES IN IRON STORAGE IN NORMAL AND DISEASED FISH,
Stirling Univ. (Scotland). Unit of Aquatic Pathobiology.
For primary bibliographic entry see Field 5A.
W80-00683

STUDY OF METAL CONTENTS OF ELASMOBRANCH FISHES: PART I-METAL CONCENTRATION IN THE MUSCLE TISSUES OF A DOGFISH, SQUALUS MITSUKURII,
Tokyo Univ. (Japan). Dept. of Agricultural Chemistry.
For primary bibliographic entry see Field 5A.
W80-00685

ENVIRONMENTAL ASSESSMENT OF AN ACTIVE OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO 1977-1978. VOLUME III: CHEMICAL AND PHYSICAL INVESTIGATIONS.
National Marine Fisheries Service, Galveston, TX. Southeast Fisheries Center.
For primary bibliographic entry see Field 5C.
W80-00692

THE LOWER BAY COMPLEX,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 2J.
W80-00695

CHEMICAL POLLUTANTS OF THE NEW YORK BIGHT; PRIORITIES FOR RESEARCH,
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
For primary bibliographic entry see Field 5C.
W80-00697

ON THE THEORETICAL BASIS OF MODELLING THE QUALITY OF SURFACE AND SUBSURFACE WATERS,
Deutsche Akademie der Wissenschaften zu Berlin (German D.R.). Inst. fuer Geographie and Geookologie.
P. Mauersberger.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 14-23, 1978. 4 ref.

Descriptors: *Water quality, *Surface waters, *Subsurface waters, *Mathematical models, Theoretical analysis, Hydrologic cycle, Model studies, Equations, Entropy, Analytical techniques, Ecosystems, Thermodynamics, Analytical techniques, Momentum equation, Continuity equation, Energy equation, Mathematical studies, Chemical processes, Biochemical processes.

The system of equations characterizing deterministic water quality models takes into account the conservation of mass and momentum, the energy balance, and equations describing chemical, biochemical, and biological processes. It was pointed out that this system of equations must be completed by adding the entropy principle. The mutual effects of entropy-producing and entropy-reducing processes regulate the structure, state, and development of the subsystems of the hydrological cycle. (See also W79-00379) (Humphreys-ISWS)
W80-00700

A DYNAMIC MODEL OF THE CHEMICAL NUTRIENT SYSTEM FOR RESEARCH OF THE ECOLOGICAL CONSEQUENCES IN NATURAL WATER,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
A. V. Leonov.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 24-36, 1978. 5 fig, 1 tab, 9 ref.

Descriptors: *Nutrients, *Water quality, *Mathematical models, *Bioindicators, Ecosystems, Model studies, Biochemical oxygen demand, Theoretical analysis, Analytical techniques, Computer models, Bacteria, Protozoa, Aquatic microorganisms, Metabolism, Productivity, Organic matter, Primary productivity, Secondary productivity, Equations, Dynamic models.

This paper presented a mathematical model of the ecological-biochemical system. The model is intended for investigation of the interaction o

chemical components with the living matter of natural water and of the transformation of organic and inorganic substances and of biochemical oxygen uptake. The transformation of dissolved organic matter, of organic and inorganic phosphorus compounds, and oxygen uptake were discussed on the basis of computer simulation results. The phosphorus compounds turnover intensity along different transformation pathways was estimated. The calculations of the quantity of transforming matter showed that significant mistakes may be received in the evaluation of some included metabolism transforming compounds directly from experimental data if the formation of secondary matter is not taken into account. The conclusion must be drawn with great caution on the basis of these estimations. For example, formation of the secondary organic matter can give the illusion of stability of the initial organic matter to biochemical destruction in the period of minimal biomass of the bacteria and maximal biomass of the predators. The consumption of oxygen is the best indication of biochemical activity of the non-photosynthetic system in this case, with the total combination of, for example, the data on the accumulation of CO2 and mineral nitrogen compounds. The mathematical model considered may be used for analysis of the following: (1) complex observed results in dark laboratory conditions; (2) data on the dynamics of components under the photosynthetic layer of simple hydrodynamic models; (3) as the basis for a sub-model of more complex models of real natural productivity systems; and (4) for the investigation of self-purification processes in water. (See also W79-00379) (Humphreys-ISWS)
W80-00701

AN EFFORT FOR MODELLING THE TRANSPORT OF MICROPOLLUTANTS IN RIVERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
L. Somlyody.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 39-49, 1978. 5 fig, 20 ref.

Descriptors: *Water pollution, *Mathematical models, *Rivers, Heavy metals, Model studies, Pollutants, Movement, Theoretical analysis, Analytical techniques, Mercury, Lead, Cadmium, Bottom sediments, Physicochemical properties, Suspended solids, Numerical analysis, Spatial distribution, *Micropollutant transport, *Hungary, *River Sajo(Hungary), Mass balance.

The modelling of the transport of heavy metals differs essentially from that for other pollutants. Basically, heavy metals can be found in three states: in dissolved and in solid form in the water body and in the polluted bottom sediment. Their transport is affected by several physical, physicochemical, and biochemical processes, such as convection, dispersion, settling, deposition, re-entrainment, change between dissolved and solid form, aggregation, etc. In general, the solid form and the bottom sediment are characterized by their particle size distribution. A mathematical model of one-dimensional character in space was worked out on the basis of mass balance equations written for all three states. For the numerical solution, an explicit method of finite differences was applied. The numerical stability was proved. A hypothetical example was presented in which the effect of floods was studied beside continuous pollutant discharge. The computed variations correspond to the expected pattern gained from measurements performed on the River Sajo. However, to achieve this, the distribution of particle sizes also had to be taken into consideration. (See also W79-00379) (Humphreys-ISWS)
W80-00702

HYDROLOGICAL AND GEOCHEMICAL MASS BALANCE IN SMALL FORESTED AND AGRICULTURAL BASINS,
Corporation for Engineering, Geological and Hydrological Investigation, Prague (Czechoslovakia). Stavebni Geologie.
For primary bibliographic entry see Field 2A.
W80-00703

EFFECTS OF THE CONSTRUCTION OF A BROAD WATERWAY ON THE WATER QUALITY OF THE DOUBS (EFFETS DE LA CANALISATION A GRAND GABARIT SUR LA QUALITE DES EAUX DU DOUBS),
Electricite de France, Chatou. Direction des Etudes et Recherches.
E. Chalon, D. Momal, and C. Sabaton.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 59-67, 1978. 7 fig, 3 ref.

Descriptors: *Water quality, *Rivers, *Mathematical models, Calibrations, Analytical techniques, Dissolved oxygen, Model studies, Biochemical oxygen demand, Foreign research, River flow, On-site data collections, Reaeration, Biodegradation, Water temperature, Discharge(Water), *France, *Doubs River(France).

The construction of a broad waterway between the Rhone and the Rhine will strongly modify the hydraulic regime of the Doubs River (increase in depth and construction of overcrested weirs). The effect of these modifications upon the dissolved oxygen levels of the river has been studied. The originality of the method used lies in the calibration of a mathematical simulation model with actual data; the data used consist of time series (1969-1975) of hydrological, meteorological, and water quality parameters such as river flow, wind speed, air temperature and humidity, dissolved oxygen, and 5 day BOD. The model allows the statistical evaluation of the possible effect of future changes upon the dissolved oxygen level of the Doubs River, and, therefore, illustrates a methodology of impact assessment of a broad navigation system on the water quality of a river. (See also W79-00379) (Humphreys-ISWS)
W80-00704

MASS TRANSFER MODELS OF SORPTION AND DESORPTION OF RADIONUCLIDES BY AQUATIC PLANTS,
Institute of Meteorology and Water Management, Warsaw (Poland).
For primary bibliographic entry see Field 2A.
W80-00705

ON THE CHOICE OF BOUNDARY CONDITIONS FOR ONE-DIMENSIONAL MODELS OF ESTUARINE WATER QUALITY,
University Coll., Dublin (Ireland). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W80-00706

THE BIOCENOTIC MODEL,
Landesanstalt fuer Umweltschutz Baden-Wurttenberg, Karlsruhe (Germany, F.R.).
M. Boes.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 86-95, 1978. 5 fig, 8 ref.

Descriptors: *Model studies, *Water quality, *Rivers, *Water pollution, *Self-purification, Aquatic environment, Oxygen demand, Mathematical models, On-site investigations, Food chains, Management, Nutrients, Flow, Velocity, Biochemical oxygen demand, Hydraulic engineering, Aeration, Oxidation, Flow characteristics, *Germany, Biocenotic model, Oxygen budget, Organic pollution.

The biocenotic model is a quality model for flowing waters, predicting the oxygen budget and the organic pollution for given loads. In contrast to the black-box models, it is a physically based, dynamic model. The essence of the biocenotic model is the 'model biocenosis'--a complex control system in which the natural society of organisms is described in a group pattern. The principal classification criterion is the rank in the food chain. The model is applicable to very different water courses without the need for changing the structure or parameters of the 'model biocenosis' and is, therefore, an easily handled planning instrument. It has been used for planning in the field of water quality management. Since 1973, model calculations have been carried out for the rivers Neckar and Enz, Danube from Schwenningen to Ulm, Fils, Schussen, Murg, Leopoldskanal/Breisgauer Bucht, and Schmiedbach, rivers with low discharge rates from 0.005 to 30 cu m/sec, water depths from 0.1 to 8 m, river widths from 1 to 175 m, and flow velocities from 0.02 to 0.8 m/s. There was no need to adapt the regulating elements of the model to any of the rivers listed. (See also W79-00379) (Humphreys-ISWS)
W80-00707

THE USE AND LIMITATIONS OF A TWO-DIMENSIONAL MIXING MODEL FOR RIVERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
L. Somlyody.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 96-105, 1978. 8 fig, 15 ref.

Descriptors: *Model studies, *Rivers, *Mixing, *Water quality, Flow characteristics, Flow, Spatial distribution, Variability, Dispersion, Diffusion, Laboratory tests, Open channels, Open channel flow, On-site tests, Mass transfer, Mathematical models, Two dimensional models.

In wide streams the variations in the water quality parameters are fundamentally affected by transverse mixing. Therefore, using a new concept a two-dimensional mixing model was developed recently which serves as a basis for water quality models. The use of the model was illustrated by 3 examples in which computed and measured concentrations were compared. Good agreement was achieved in all the cases. However, in the last 2 examples, the spatial variation of the dispersion coefficient also had to be taken into consideration. This fact limits the use of the model as such detailed information is rarely available in practice. The expressed three-dimensional character of the flow (e.g., in the presence of sharp bends, contractions, and expansions) causes the second limiting factor. In such cases, the dispersive transport may not be described by the Frickian law; the dispersion coefficient may vary strongly in space and may become negative, too. To support this, 2 examples were given: a laboratory model of a curved open channel and a natural stream. (See also W79-00379) (Humphreys-ISWS)
W80-00708

USE OF WATER QUALITY VARIABLES FOR ESTIMATION OF WATER QUANTITY CHARACTERISTICS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W80-00709

ADAPTATION OF THE EPAECO MODEL TO A LAKE IN CENTRAL FINLAND,
National Water Board of Finland, Helsinki.
For primary bibliographic entry see Field 2L.
W80-00710

ENERGY EXCHANGE BETWEEN DEEP LAKES AND THE ATMOSPHERE AND THE CONSEQUENCES FOR THE WIND-MIXED LAYER DYNAMICS,
Haskoning, Nijmegen (Netherlands).
For primary bibliographic entry see Field 2L.
W80-00713

NUTRIENT EXCHANGE BETWEEN VOLUME ELEMENTS OF LARGE LAKES,
Canada Centre for Inland Waters, Burlington (Ontario).

For primary bibliographic entry see Field 2H.
W80-00716

WATER QUALITY IN LENTIC WATER BODIES (LAKES AND RESERVOIRS),
Salford Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W80-00717

NATURAL CONTROL OF THE CHEMICAL COMPOSITION OF WATER DURING THE INFILTRATION PROCESS--FIRST RESULTS (ACQUISITION DE LA COMPOSITION CHIMIQUE DE L'EAU AU COURS DE L'INFILTRATION EN MILIEU NATUREL--PREMIERS RESULTATS D'UNE ETUDE EXPERIMENTALE),
Bureau de Recherches Geologiques et Minieres, Orleans (France).
M. Bonnet, and A. Landreau.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 213-224, 1978. 8 fig, 2 tab, 10 ref.

Descriptors: *Groundwater, *Infiltration, *Water quality, *On-site investigations, Precipitation(Atmospheric), Water pollution, Water chemistry, Porous media, Movement, Dissolved solids, Strontium, Sodium, Calcium, Aquifers, Water properties, Carbonates, Unsaturated flow, On-site tests, Hydrogen ion concentration, Magnesium, Potassium.

The object of this study was to define the various mechanisms involved in the natural controls of the chemism of an underground aquifer fed only by precipitation. This investigation was conducted with the view to develop a conceptual model of the evolution of the chemical composition of the water, in which the water-transfers would also be involved. The study was performed on an experimental site so that all major natural factors involved in the control of the water chemism would come into play. The non-saturated zone is made up of silt, 3 m thick, and chalk, 5 m thick. The first results pertaining to the evolution of the water quality were presented. The salt content gradually increases as the water progresses through the silt, then it falls abruptly as the water passes through the weathered chalk. The equilibrium dissolved silica-silicated rocks is quickly reached within the first meter. The Na and Ca contents vary suddenly as the water flows through clayey layers (base exchange) and weathered chalk (precipitation). The prospects and results expected from this investigation were also discussed. (See also W79-00379) (Humphreys-ISWS)
W80-00719

COMPUTATION OF THE ADVANCEMENT OF GROUNDWATER POLLUTION DUE TO PETROLEUM PRODUCTS ORIGINATING FROM A KNOWN SOURCE OF CONTAMINATION (LE CALCUL DE LA PROPAGATION DE LA POLLUTION DES EAUX SOUTERRAINES PAR DES MATERIAUX HUILEUX, PROVENANTS D'UNE SOURCE DE LA POLLUTION CONNUE),
Vyzkumny Ustav Vodohospodarsky, Bratislava (Czechoslovakia).
J. Sumbal.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 225-236, 1978. 1 fig, 2 tab, 8 ref.

Descriptors: *Water pollution, *Groundwater, *Mathematical models, *Path of pollutants, Water pollution sources, Oil, Computer models, Model studies, Analytical techniques, Equations, Organic compounds, Movement, Porosity, Aquifer characteristics, Water temperature, Infiltration.

Pollution of groundwater by petroleum products occurs firstly as the movement of oil in the liquid phase, being separated from the water and then as the propagation of small quantities of oil dissolved in the water. The computation program presented shows a good agreement between computed results and measurements, performed in the nature of oil advancement in the liquid phase. The second program, of which the principles were explained, allows one to compute the isolines of pollution concentration originating from oil spread on the surface computed by the first program. (See also W79-00379) (Humphreys-ISWS)
W80-00720

PETROLEUM HYDROCARBONS IN URBAN RUNOFF,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., and J. V. Hunter.
Water Resources Bulletin, Vol. 15, No. 4, p 1096-1105, August 1979. 2 fig, 5 tab, 8 ref.

Descriptors: *Urban runoff, *Organic compounds, *Oil, *Water pollution, Water pollution sources, Pollutants, Path of pollutants, Water quality, Water quality control, Storm runoff, Urban drainage, Urbanization, Cities, Land use, Sampling, Data processing, Model studies, Mathematical models, Analytical techniques.

Estimates were made of petroleum hydrocarbon pollution loadings reaching the Delaware Estuary by determining storm event loadings of hydrocarbons from 4 storm sewers draining areas of different land uses. Although refinery effluents constituted the largest source of petroleum pollution in 1975, it appears that after completion of currently required treatment processes, urban runoff will be the largest remaining source of petroleum pollution. The petroleum in urban runoff resembles used crankcase oil in composition and contains toxic chemicals such as polynuclear hydrocarbons. Further research is clearly desirable. Remedial programs to control such pollution may be warranted on the basis of information now available. (Sims-ISWS)
W80-00730

CONTAMINATION POTENTIAL IN THE SILURIAN DOLOMITE AQUIFER, EASTERN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
M. G. Sherrill.
Geological Survey Water-Resources Investigations 78-108 (open-file map), May 1979. 2 sheets, 11 ref.

Descriptors: *Water quality, *Groundwater, *Dolomite, *Aquifers, *Surface-groundwater relationships, Aquifer characteristics, Water pollution sources, Subsurface mapping, Groundwater movement, Groundwater recharge, Transmissivity, *Silurian dolomite aquifer(WI), *Eastern Wisconsin, *Groundwater contamination potential.

The Silurian dolomite aquifer is used for water supply in much of a 14-county area bordering Lake Michigan in eastern Wisconsin. Because of the rapidity of ground-water movement, the aquifer is susceptible to contamination by waters percolating downward from surface sources. Maps showing the distribution of permeability, the thickness of unconsolidated materials, and the depth to the water table are combined to show areas where the dolomite aquifer has the greatest contamination potential. Several areas have above-normal potential for contamination. These include the Casco-Luxemburg area of Kewaunee County, the area south of Chilton in Calumet County, a part of western Manitowoc County, drainageway areas in Sheboygan County, the Byron-Campbellsport area of Fond du Lac County, the Sussex-Lannon-Cedarburg areas of Waukesha and Ozaukee Counties, and the Racine-Burlington areas of Racine County.
W80-00757

EVALUATION OF A DIGITAL MODEL FOR ESTUARINE WATER QUALITY SIMULATION IN WASTE ALLOCATION STUDIES,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. E. Seaburn, M. E. Jennings, and M. L. Merritt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 820, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-54, 1979. 50 p, 20 fig, 8 tab, 12 ref.

Descriptors: *Path of pollutants, *Estuaries, *Model studies, *Waste water(Pollution), *Mathematical models, Tidal effects, Mass transfer, Water quality, Dissolved oxygen, Biochemical oxygen demand, Chlorides, Nitrogen, *Finite difference method, *Steady state conditions, Florida, *Pasco County, *Citrus County, *Pinellas County.

Hydrologic and water-quality data were collected on 4 estuaries in Pasco, Citrus, and Pinellas Counties, Florida, to evaluate modeling results. Current and predicted waste loading of the four estuaries was simulated by use of a two-dimensional steady-state, intertidal-condition model. Concentrations of DO, carbonaceous and nitrogenous BOD, and chloride were simulated as averages over a tidal cycle. General equations for the model are based on the law of conservation of mass. Assumption of steady-state required that water-quality data for calibration be averaged over an appropriate time cycle with respect to volume and cross-section. Diurnal DO fluctuation was determined in 2 estuaries for evaluating the influence of photosynthesis and respiration. The estuary model is best applied by calibrating it for a particular set of observed conditions, and then using this calibrated model for sensitivity analyses without attempting to verify the chosen parameter values against a second set of conditions. Sensitivity analyses included dispersion coefficient, decay rates, photosynthesis, and respiration. (Woodard-USGS)
W80-00761

WATER-QUALITY ASSESSMENT OF RUNOFF FROM A RURAL HIGHWAY BRIDGE NEAR TALLAHASSEE, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. A. Irwin, and G. T. Losey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 359, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-1, 1978. 27 p, 2 fig, 7 tab, 10 ref.

Descriptors: *Water quality, *Runoff, *Bridges, Highways, Water pollution sources, Sampling, Water analysis, Trace elements, Pesticides, Bacteria, Oil, Suspended solids, Chemical analysis, Precipitation(Atmospheric), Streamflow, Evaluation, Regression analysis, Florida, *Automotive vehicles, *Leon County(Fla), *Gadsden County(Fla), *Ochlockonee River, U.S. Highway 27.

Runoff from a rural highway bridge on U.S. 27 near Tallahassee, Florida, was found to have an insignificant water-quality loading impact on the Ochlockonee River. Potential annual-runoff loads on the bridge surface for virtually all constituents studied were less than one percent of those transported by the river at the study site. The loading rates for some parameters were significantly related to traffic counts, but the regression equations were limited to traffic ranges between 3,800 to 4,200 vehicles per day in 1977-78. Precipitation samples indicated that a significant percentage of the constituent loading to the bridge surface is from atmospheric deposition. (Woodard-USGS)
W80-00767

A PRELIMINARY APPRAISAL OF THE IMPACT OF AGRICULTURE ON GROUNDWATER AVAILABILITY IN SOUTHWEST GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-00770

STORMWATER-RUNOFF DATA FOR A COMMERCIAL AREA, BROWARD COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.

For primary bibliographic entry see Field 4C.
W80-00772

ESTIMATING THE GAS AND DYE QUANTITIES FOR MODIFIED TRACER TECHNIQUE MEASUREMENTS OF STREAM REAERATION COEFFICIENTS,
Geological Survey, NSTL Station, MS. Water Resources Div.
R. E. Rathbun.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 015, Price Codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-27, February 1979. 42 p, 5 fig, 7 tab, 29 ref.

Descriptors: *Reaeration, *Streams, *Measurement, *Tracers, *Dye releases, Tracking techniques, Flow rates, Dye dispersion, Mixing, Equations, Estimating, *Reaeration coefficient, *Nonradioactive tracers, Hydrocarbon gases, Rhodamine-WT dye, Time of travel.

Measuring the reaeration coefficient of a stream with a modified tracer technique has been accomplished by injecting either ethylene or ethylene and propane together and a rhodamine-WT dye solution into the stream. The movement of the tracers through the stream reach after injection is described by a one-dimensional diffusion equation. The peak concentrations of the tracers at the downstream end of the reach depend on the concentrations of the tracers in the stream at the injection site, the longitudinal dispersion coefficient, the mean water velocity, the length of the reach, and the duration of the injection period. The downstream gas concentrations also depend on the gas desorption coefficients of the reach. The concentrations of the tracer gases in the stream at the injection site depend on the flow rates of the gases through the injection diffusers, the efficiency of the gas absorption process, and the stream discharge. The concentration of dye in the stream at the injection site depends on the flow rate of the dye solution, the concentration of the dye solution, and the stream discharge. Equations for estimating the gas flow rates, the quantities of the gases, the dye concentration, and the quantity of dye together with procedures for determining the variables in these equations are presented. (Woodard-USGS)
W80-00773

A MORPHOMETRIC STUDY OF LEAD AND COPPER EFFECTS ON DIATOMA TENUE VAR. ELONGATUM (BACILLARIOPHYTA),
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 5A.
W80-00782

BIOGEOCHEMISTRY OF SELECTED HEAVY METALS IN WESTERN PORT, VICTORIA, AND USE OF INVERTEBRATES AS INDICATORS WITH EMPHASIS ON MYTILUS EDULIS PLANULATUS,
Victoria Ministry for Conservation, Melbourne (Australia).
For primary bibliographic entry see Field 5A.
W80-00788

UPTAKE OF CADMIUM BY THE EELGRASS ZOSTERA MARINA,
Adelphi Univ., Garden City, NY. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-00789

RESPONSES OF MARINE FOULING COMMUNITIES TO SEWAGE ABATEMENT IN KANEOHE BAY, OAHU, HAWAII,
Research Corporation of the University of Hawaii, Honolulu.
E. B. Rastetter, and W. J. Cooke.
Marine Biology, Vol. 53, p 271-280, 1979. 4 fig, 2 tab, 24 ref.

Descriptors: *Fouling, *Sewage effluents, *Dominant organisms, Cyanophyta, Diatoms, Biological communities, Outlets, Nutrients, Domestic wastes, Water chemistry, Marine algae, Biomass, Kaneohe Bay(HI), *Species diversity.

The development of marine fouling communities was followed as part of a sewage abatement study in Kaneohe Bay. Panels immersed near the outfall during sewage discharge were dominated by dense mats of blue-green algae and diatoms. This mat was significantly lighter at this station when sewage did not flow into the bay, and it never developed on panels within the same sector of the bay but away from the influence of the outfall. Taxonomic diversity, and the frequency of filamentous algae and the serpulid Hydroides elegans were reduced near the outfall during discharge. It is suggested that this reduction in diversity and abundance of certain key foulers is due to competitive exclusion by the dense blue-green and diatom mats, and is not a direct effect of the sewage effluent. (Deal-EIS)
W80-00791

EFFECTS OF ARTIFICIAL EUTROPHICATION ON THE METABOLISM OF THE JAPANESE OYSTER CRASSOSTREA GIGAS,
Tohoku Univ., Sendai (Japan). Dept. of Fisheries.
K. Mori.
Marine Biology, Vol. 53, p 361-369, 1979. 8 fig, 3 tab, 14 ref.

Descriptors: *Eutrophication, *Oysters, *Toxicity, Animal metabolism, Mortality, Industrial wastes, Domestic wastes, Mode of action, Commercial shellfish, Animal physiology, Respiration, Lipids, Seasonal.

Matsushima Bay, one of the richest oyster-culture areas in Japan, is subject to heavy artificial eutrophication, mainly from the inflow of city and factory sewages. The physiological activity in the oyster Crassostrea gigas in hanging cultures (i.e., suspended in wire-mesh cages) in this embayment declines markedly with progressive development of the gonads. This decline in activity coincides with eutrophication-induced accumulation of fatty material in the epithelia of the digestive organs. The oyster is thereby forced to depend on these accumulated fats for respiratory substrates in order to maintain its increased physiological needs. However, the fats are inefficient energy sources for the oyster and hence, during each spawning season, 50% mortality occurs. In addition, such phenomena as over-maturation of the gonad and disturbance of the lipid and steroid metabolism seem to accelerate this mass mortality. On the basis of the results, the author has compiled a schematic diagram which illustrates the possible causes of mass mortality among C. gigas in an eutrophic environment such as Matsushima Bay. (Deal-EIS)
W80-00792

THE ROCK OYSTER SACCOSTREA GLOMERATA AS AN INDICATOR OF TRACE METALS IN HONG KONG,
Fisheries Research Station, Aberdeen (Hong Kong).
For primary bibliographic entry see Field 5A.
W80-00793

SURVEY OF THE POLLUTION IN A COASTAL AREA OF THE TYRRHENIAN SEA. AERIAL PHOTOGRAPHY, PHYSICO-CHEMICAL AND MICROBIOLOGICAL INVESTIGATIONS AND MUTAGENIC MONITORING,
Genoa Univ. (Italy). Inst. of Hygiene.
For primary bibliographic entry see Field 5A.
W80-00796

LEAD AND MERCURY IN LESSER SNOW GEESE WINTERING IN LOUISIANA,
Fish and Wildlife Service, Jena, LA. Catahoula National Wildlife Refuge.
For primary bibliographic entry see Field 5A.
W80-00799

5C. Effects Of Pollution

EUTROPHICATION AND REHABILITATION OF SURFACE WATERS,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 811-814.

Descriptors: *Eutrophication, *Lake restoration, *Water pollution control, *International cooperation, *Nutrients, Lakes, Nitrogen, Phsophates, Phosphorus, Sewage treatment, Legislation, Regulation, Water utilization, Reservoirs, Potable water, Impoundments, Chemical precipitation, Nutrient removal, Beneficial use, Training, Industrial wastes, Effluents, Waste water disposal, Water pollution effects, Ecology.

The United Nations Environment Program sponsored an international symposium on eutrophication and rehabilitation of surface waters, held September 1976 at Karl-Marx-Stadt, East Germany; this report outlines its objectives and recommendations. The latter include laws, standards, and guidelines for protecting surface waters and preventing eutrophication; these include regulations for optimum water use, reduction of wastewater nutrient content prior to disposal, establishment of protected zones and conservation areas, and monitoring systems. Eutrophication prevention measures: (1) elimination of nutrient sources prior to drinking-water reservoir construction; (2) improvement of sanitation and sewage disposal systems, particularly in impoundment basins; (3) proper sewage treatment if agricultural or forestry use is intended; (4) recycling and recovery of fertilizing materials from industrial wastes prior to discharge; (5) protection of water from heated effluents; (6) runoff and erosion control; (7) development of substitutes for detergents; (8) international cooperation. Methods for rehabilitation of eutrophic waters include: (1) desludging of eutrophic waters, (2) drainage of nutrient-enriched hypolimnetic waters; (3) artificial aeration, (4) aquatic plant control, (5) nutrient precipitation from water and sediment, and (6) improving water flow. Beneficial use can be made of harvested plants, and nutrients in eutrophic waters are suitable for fisheries improvement. Training and educations should be promoted. (Lynch-Wisconsin)
W80-00417

THE ENVIRONMENTAL IMPACTS OF THE ASWAN HIGH DAM,
Academy of Scientific Research and Technology, Cairo (Egypt).
M. Hafez, and W. K. Shenouda.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 1777-1786.

Descriptors: *Reservoirs, *Aswan High Dam(Egypt), *Environmental effects, *Water storage, *Ecosystems, Artificial lakes, Rainfall, Dams, Impoundments, Nile River, Sudan, Lake Nasser(Egypt), Lake Nuiba(Sudan), Tourism, Rivers, Fisheries, Agriculture, Flood protection, Social impact, Public health, Schistosomiasis, Eutrophication, Ecology, Hydroelectric power, Navigation, Cost-benefit analysis.

Completion in 1968 of the Aswan High Dam on the Nile River in Egypt has profoundly affected the entire Nile Basin in Egypt and the Sudan, but benefits far outweigh negative effects. The dam created a 500-km lake, known as Lake Nassar in Egypt and Lake Nubia in the Sudan, which provides for 'century storage' of water which accumulates during the 50-year cycle of heavier rainfall and is used during the 50-year period of reduced rainfall. Benefits include: (1) a sufficient water supply for agricultural and industrial growth, (2) doubling of electric power output, (3) greatly augmented fishery in Lake Nasser, (4) high and low flood protection, (5) improved navigation, and (6) increased tourism. Negative effects: (1) inundation of vast areas of land requiring relocation of 50,000 people and several historical monuments; (2) a change from a riverine to a lacustrine system; (3)

regulation of the once-variable water flow, with reduction of flow to the Mediterranean by as much as 100 cu km/yr; (4) loss of 60 million cu m/yr reservoir capacity due to siltation, with increased river bed and bank erosion; (5) increased evaporation from the reservoir from six to 10 cu km/yr; (6) alteration of shoreline ecology; (7) an anaerobic lake hypolimnion, (8) alteration of river morphology, water quality, and ecology, including eutrophication and excessive plant growth; (9) social changes as a result of improved agriculture, fishing, and employment; (10) an increase in schistosomiasis; and (11) increased irrigation canal salinity. (Lynch-Wisconsin)
W80-00446

DETERIORATION OF WATER QUALITY DUE TO LONG RANGE TRANSPORT OF AIR POLLUTION,
For primary bibliographic entry see Field 5G.
W80-00458

ESTABLISHMENT OF QUALITY CRITERIA FOR WATER USE IN AUSTRALIA,
Caulfield Inst. of Tech., Victoria (Australia). Water Studies Centre.
For primary bibliographic entry see Field 6E.
W80-00460

PHYSIOLOGICAL ADAPTATIONS OF SALMONID FISHES (SALMO CLARKI HENSHAWI, SALMO GAIRDNERI, AND ONCORHYNCHUS KISUTCH) TO ALKALINE SALINE WATER AND THEIR TOXIC EFFECTS,
Nevada Univ. System, Reno. Desert Research Inst.
For primary bibliographic entry see Field 2H.
W80-00488

IMPACTS OF A LARGE RECREATIONAL DEVELOPMENT ON WATER QUALITY IN A SEMI-PRIMITIVE ENVIRONMENT,
Montana State Univ., Bozeman. Inst. of Applied Research.
D. G. Stuart, G. Roemhild, T. T. Williams, J. J. Jezeski, and J. E. Schillinger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 220, Price codes: A05 in paper copy, A01 in microfiche. Report No. NSF/RA-761543. December 1976. 70 p, 23 fig, 10 tab, 10 ref, 3 append. GI29908x, GI29908x1, GI39592.

Descriptors: *Montana, *Water quality, *Land development, *Recreation, Sewage, Effluents, Hydrology, Groundwater, Water analysis, Water pollution, Water treatment, Water resources, Surface waters, Land use, Recreation facilities, Environmental effects, Recreation wastes.

Large recreational developments such as the Big Sky Resort in Montana can be compatible with high water quality found in semi-primitive areas, if developments are properly sited, carefully planned, and money is spent to adequately implement plans. Construction commenced in 1970 for the multi-million dollar resort in the West Fork basin of the Gallatin River, southwestern Montana. Research involved surface water and groundwater quality studies of the Gallatin Canyon area. Physicochemical and bacteriological parameters as well as water quantity were studied prior to, during, and after construction. Samples from 1970-1974 revealed considerable surface streamflow variation seasonally and annually; however, streamflow changes from commercial development were not detected. Water table elevations in two wells dropped from 108-124 in and 78-81 in between August 1972 and October 1973. The drop resulted drom increased pumping for domestic and irrigation purposes. Groundwater and surface waters from Gallatin River and tributaries are generally of high water quality and little degradation evidence was observed except for some transient sediment slugs during heavy construction resulting in aquatic insect population changes. Aquatic insect populations doubled near sewage lagoons compared to other sites. Although the resort is not yet fully developed, surface and groundwater quality could be maintained unless sewage-treatment, a proposed 'no discharge' system, fails to function according to design. (Danovich-Wisconsin)
W80-00498

THE BIOCHEMICAL COMPOSITION OF THE LARVAE OF TWO STRAINS OF ARTEMIA SALINA (L.) REARED ON TWO DIFFERENT ALGAL FOODS,
Ghent Rijksuniversiteit (Belgium). Lab. for Biological Research in Environmental Pollution.
C. Claus, F. Benijts, and G. Vandeputte.
Journal of Experimental Marine Biology and Ecology, Vol 36, No 2, p 171-183, January 1979. 1 Fig, 5 Tab, 39 Ref.

Descriptors: *Brine shrimp, *Algae, *Diets, *Growth rates, *Nutrient requirements, Aquiculture, Shrimp, Nutrients, Larval growth stage, Larvae, Metabolism, Animal physiology, Carbohydrates, Biochemistry, Lipids, Proteins, Amino acids, Digestion.

This biochemical culture investigation of effects of feeding Great Salt Lake and San Francisco Bay Artemia nauplii (brine shrimp) for 48 h on a diet of dried Scenedesmus or Spirulina algae confirms that a planktonic organism's biochemical structure and nutritional value is not only genetically determined but is also influenced by physiological age and various environmental factors such as ingested food. Both newly hatched nauplii and larvae starved for 48 h were analyzed as controls. The first instar stage nauplii from Great Salt Lake were significantly larger than those from San Francisco Bay. Larvae of both strains grew faster on Spirulina than on Scenedesmus cells, which is explained by the higher Spirulina protein content (72% compared with 55% Scenedesmus). During 48 h starvation, ash content of the San Francisco Bay larvae doubled (8.17-19.97% body weight), whereas Great Salt Lake larvae increased only 40% (9.52-13.29); carbohydrates and lipids percentage decreased. When larvae were fed, increases in organic content surpassed those in inorganic content, resulting in lower ash content percentages. Starvation results in a relative decrease in some fatty acids such as palmitic, linoleic, and linolenic acids, as others increase (stearic, oleic, and arachidic acids). Major changes occur in fatty acid patterns during fed animals' aging process: Spirulina fed larvae have high levels of linoleic and C20:1 acid, Scenedesmus fed larvae have high levels of C19:1, linolenic acid, and peak 14. (Danovich-Wisconsin)
W80-00502

PHOSPHORUS CYCLING IN ALASKAN COASTAL TUNDRA: A HYPOTHESIS FOR THE REGULATION OF NUTRIENT CYCLING,
Alaska Univ., Fairbanks. Inst. of Arctic Biology.
F. S. Chapin, III, R. J. Barsdate, and D. Barel.
Oikos, Vol 31, No 2, p 189-199, 1978. 4 Fig 2 Tab, 73 Ref.

Descriptors: *Phosphorus, *Cycling nutrients, *Microbial degradation, *Tundra, Alaska, Barrow(AK), Nutrients, Degradation(Decomposition), Balance of nature, Arctic, Soil microorganisms, Soil microbiology, Cold regions, Cycles, Nutrient budgets, Microorganisms, Phosphorus compounds, Organic compounds, Organic soil, Soil profiles, Soils, Soil horizons.

Periodic microbial biomass crashes in Barrow Alaskan wet meadow tundra soil release considerable dissolved inorganic phosphorus for return to the available pool for nutrient cycling. This paper describes an annual budget for phosphorus movement in a wet sedge meadow. The area's growing season is characterized by a four C average air temperature mid-June to late August and continuous solar radiation; tundra soil thaws to 25 cm maximum depth during this time. The system's total nutrient quantity to 20 cm is 19,800 g C sq m and 59.3 g P sq m with 1.3% and 1.3% P in live vegetation. Sixty-four percent of P is organic with 95% of this bound in dead soil organic matter and only 2.2% in live plants and animals. Eighty-four percent of the 21,000 mg sq m inorganic P is non-exchangeable. Only 0.5% of the soil organic P pool turns over each year, giving a residence time of 220 yr. Dissolved inorganic P pools have a net residence time of 10 h. Phosphorus distribution varies strikingly with depth: rapidly circulating pools predominate in upper soils, whereas slowly circulating pools occur more often at depth. Phosphorus input to Barrow tundra is negligible; therefore, the system depends upon internal cycling. Low temperature limits organic matter decomposition, not by its direct effect upon microbial metabolism but rather upon the rates of microbial biomass increases following observed periodic population crashes. (Danovich-Wisconsin)
W80-00503

STRUCTURE AND SUCCESSION IN ROCKY ALGAL COMMUNITIES OF A TEMPERATE INTERTIDAL SYSTEM,
Instituto de Investigaciones Pesqueras, Vigo (Spain).
F. X. Niell.
Journal of Experimental Marine Biology and Ecology, Vol 36, No 2, p 185-200 January 1979 11 Fig, 2 Tab, 25 Ref.

Descriptors: *Intertidal areas, *Succession, *Algae, *Biological communities, Population, Vigo, Spain, Biomass, Competition, Plant populations, Pigments, Ecological distribution, Distribution, Distribution patterns, Plankton, Habitats, Growth rates, Clear-cutting, Growth stages, Life history studies.

The transition from a channelling succession phase to normal structured communities in a intertidal community colonization experiment near Vigo in northwestern Spain is a change in the structure control system. Five algal communities, characterized by the dominance of Pelvetia canaliculata, Fucus spiralis, Himanthalia elongata plus Bifurcaria bifurcata, Himanthalia elongata, and H. elongata, and a red algal pool, were observed October 1974 to October 1975. A second, more accurate observation was only performed in the H. elongata zone October 1975 to January 1977. In cleared surface patterns are regular. Three structured colonization phases are distinguished by opportune diversity measurements; a first colonization phase, followed by a channelling succession (Ulvacean) phase, and a third normal structured community phase. Species numbers increase throughout succession although this number changes seasonally due to physically controlled fixation mechanisms independent of biologically community structure. Biomass increases during the Ulvacean phase, but different change environmental cause considerable monthly fluctutations. Diversity peaks in the overlap between phases and decreased when dominants are abundant. In the colonization phase, chlorophyll values are 300 mg chl-a sq m compared with 1200 mg chl-a sq m in more advanced communities. Pigment diversity, expressed as a ratio of absorption at 430 and 665 nm of methanol extracts, is constant. (Danovich-Wisconsin)
W80-00504

CAN PLANKTOVOROUS FISH KEEP IN CHECK PLANKTONIC CRUSTACEAN POPULATIONS. A TEST OF SIZE-EFFICIENCY HYPOTHESIS IN TYPICAL POLISH LAKES,
Warsaw Univ. (Poland). Chair of Hydrobiology.
Z. Gliwicz, and A. Prejs.
Ekologia Polska, Vol. 25, No. 4, p 567-591, 1977. 9 fig, 3 tab, 61 ref.

Descriptors: *Fish, *Biomass, *Predation, *Crustaceans, *Population, Lakes, Poland, Regression analysis, Mathematical studies, Zooplankton, Smelts, Plankton, Fish food organisms, Food chains, Mortality, Secondary productivity, Competition, Ecology, Fish populations, Aquatic populations.

The effect of planktivorous fish on planktonic Crustacea in mesotrophic and eutrophic Polish lakes is influenced by unspecialized rather than specialized predators, modifying interspecific competition results by favoring presently higher ecologically reproductive species even if these represent competitively weaker forms. The study tested the degree that planktivorous fish predation was

responsible for pelagic zooplankton species composition, seasonal changes, crustacean mortality, and mean crustacean size, in typical central European lakes where main pelagic planktivorous fish are usually vendace, smelt, and bleak. Regression analyses measured the relationship between zooplankton communities structure and predation intensity. Research was done on 30 holomictic lakes June-July 1975 and more detailed work was carried out on eutrophic Lake Mikolajskie (surface 460 ha, max. depth 27.8 m, average depth 11 m) and mesotrophic Lake Taltowisko (surface 327 ha, max. depth 39.5 m, average depth 14 m) 1966-1967 and 1968-1969, respectively. Fish predation is not the main factor responsible for crustacean or cladoceran population elimination. Fish predation is also not considered the essential factor in different average adult sizes, increased mortality, or diminished population reproductivity. Multiple regression analysis results, in which various zooplankton community structure parameters were dependent on many independent variables, show that fish predation rarely elevates coefficient values. (Danovich-Wisconsin)
W80-00505

SURVEY OF SWIMMING POOL ALGAE OF THE PHOENIX, ARIZONA, METROPOLITAN AREA,
Arizona State Univ., Tempe. Dept. of Botany and Microbiology.
R. P. Adamson, and M. R. Sommerfeld.
Journal of Phycology, Vol. 14, No. 4, p 519-521, December 1978. 2 tab, 14 ref.

Descriptors: *Algae, *Chemistry, *Swimming pools, *Phoenix, AR, Arizona, Cyanophyta, Chlorophyta, Chrysophyta, Water chemistry, Physicochemical properties, Habitats, Recreation facilities, Swimming.

Although correlation of physicochemical data with algal species proved futile, this survey identified algal species inhabiting 110 swimming pools in the Phoenix, Arizona metropolitan area. Twenty-four algal species representing four classes were identified. Most belong to Cyanophyta; however, Pleurochloris pyrenoidosa (Xanthophyceae) is dominant, occurring in 67% of the pools. Filamentous cyanophytes, Phormidium and Plectonema are the next most common. Chlorophyta are found in less than 5% of the pools. All Cyanophyceae species and diatom Nitzschia communis are firmly attached to pool surfaces; Pleurochloris pyrenoidosa is loosely attached. Chlorophyceae members are free floating or suspended. In many pools, algal suspensions limit water visibility to a few centimeters. Dominant species in these pools are Oocystis and Chlamydomonas. Algae inhabit swimming pool areas with poor water circulation and particulate matter buildup. Temperature ranges 23-30C, whereas pH and total chlorine are 6.6-9.2 and 0-3.0 mg l, respectively. Free chlorine levels, a disinfective potential indicator, ranges 0-3.0 mg/l; total hardness is 210-1580 mg CaCO3 l. (Danovich-Wisconsin)
W80-00506

EXPERIMENTAL AND FIELD STUDIES ON ECOLOGICAL ENERGETICS OF ASELLUS AQUATICUS L. (ISOPODA). ENERGY BUDGET OF A POPULATION IN THE LITTORAL ZONE OF POWSINSKIE LAKE,
Polish Academy of Sciences, Warsaw. Dept. of Ecological Bioenergetics.
T. Prus.
Ekologia Polska, Vol 25, No 4, p 593-623, 1977. 7 fig, 8 tab, 32 ref.

Descriptors: *Energy budget, *Productivity, *Regression analysis, *Isopods, Mathematical studies, Energy transfer, Population, Biomass, Respiration, Standing crops, Metabolism, Energy conversion, Energy dissipation, Ecology, Poland.

For three consecutive seasons, 1972-1974, experimental and field studies lasting 176, 217, and 182 days were performed on bioenergetics of Asellus aquaticus, instantaneous and cumulative energy budgets were calculated, and maintenance costs were estimated by predictive and functional methods. Cumulative energy budgets, averaged for three half-year seasons, were: 4.3 kcal sq m (production), 16.3 kcal sq m (maintenance costs), 20.6 kcal sq m (assimilation), 47.5 kcal sq m (unassimilated energy), 68.1 kcal sq m (consumption) according to predictive estimates or 4.3 (production), 14.1 (maintenance costs), 18.4 (assimilation), 42.4 (unassimilated energy), and 60.8 (consumption) kcal sq m functional estimates. Average cumulative gross production efficiency was 6.3% (predictive) or 7.1% (functional) and average cumulative net production efficiency was 21% (predictive) or 23.5% (functional). Cumulative production per season amounted to 6.5 kcal sq m (1972), 4.1 kcal sq m (1973), and 2.8 kcal sq m (1974). Adult: juvenile proportion was relatively constant, 3:2. Cumulative production-to-average biomass ratio ranged 6:1-3.3:1, averging 4.3:1. Cumulative maintenance cost was expressed as the sum of biomass and production respiration. About 67% of population respiratory metabolism was by adults. Energy flow through the population mainly occurs in late spring by May, June and very little energy flow occurs in summer. Asellus aquaticus as an energy recuperator was also discussed. (Danovich-Wisconsin)
W80-00507

THE EFFECT OF INTENSE FERTILIZATION ON MIGRATION OF NITROGEN COMPOUNDS IN SOIL,
Technical Univ. of Warsaw (Poland). Dept. of Sanitary Environmental Engineering.
Z. Szperlinski, and K. Badowska.
Ekolgia Polska, Vol 25, No 4, p 689-702. 1977. 7 fig, 3 tab, 7 ref.

Descriptors: *Ammonium compounds, *Nitrates, *Fertilizers, *Ion transport, *Rainfall intensity, Leaching, Water pollution sources, Nitrogen compounds, Soils, Soil types, Soil chemistry, Poland, Correlation analysis, Soil chemical properties, Rainfall, Water pollution, Path of pollutants, Runoff, Adsorption, Rain, Laboratory tests.

Excessive nitrogen fertilization even at low rainfall results in nitrate accumulation below the root zone; if a long-lasting intense rainfall occurs, nitrate migrates through the soil to pollute groundwater. This laboratory study is concerned with migration dynamics of ammonium and nitrate ion under influence of rainfall in soils fertilized with different amounts of ammonia nitrate, and utilizes loamy silty sand, loamy silt, and light silty clay from near Warsaw, Poland. Soils were fertilized with 200,400, and 600 kg ammonia nitrate/ha and rainfall levels were 20, 40, 60, 80, and 100 mm. Most ammonium ions remained in the 0-6 cm soil level. Ammonium desorption was 5-8 times higher for weak loamy silty sand as compared with light silty clay where-as the ion-exchange capacity ratio of these soils was 1:4.1. In weakly loamy silty sand, ammonium ion desorption due to 80 and 100 mm rainfall was 2.21 and 4.70 kg ammonium ha respectively. Ammonium ions displacement depends upon rainfall rate and soil sorption properties and to a lesser extent, ammonia nitrate concentrations. Nitrate ions migrate gradually; increasing rainfall levels result in nitrate displacement and the disappearance of nitrate peak concentrations in soil layers. Leaching nitrate levels correlates linearly with ammonia nitrate amounts in soil fertilizers. (Danovich-Wisconsin)
W80-00508

THE INFLUENCE OF FERTILIZATION ON PHYTOPLANKTON IN PONDS WITH VARIED DEVELOPMENT OF BIOCOENOSE,
Instytut Rybactwa Srodladowego, Zabieniec (Poland). Dept. of Fish Culture.
M. Januszko.
Ekologia Polska, Vol 25, No 4, P 625-634, 3 fig, 2 tab, 9 ref.

Descriptors: *Fertilization, *Ponds, *Growth rate, *Primary productivity, *Phytoplankton, Biomass, Productivity, Environmental effects, On-site tests, On-site tests, On-site investigations, Poland, Biological community, Nutrients, Ammonia, Algal poisoning, Chlorophyta, Algae, Eco-systems.

This 1974 experiment on seven ponds at the Inland Fisheries Institute, Wilga, Poland, concludes that fertilization effects of phytoplankton depends on biocoenose development stage at the time of fertilizer addition. Nutrients (330 kg/ha urea and 330 kg/ha superphosphate) were introduced in different ponds on three occasions: (1) during weak organism interactions at the onset of young biocoenose seasonal development immediately after pond filling; (2) a month later, when biocoenose development was advanced; and (3) following biocoenose poisoning during community renewal. In type 1, phytoplankton develops fast and maintains a high level; seasonal mean algal numbers were 89,500 cu cm and biomass, 20.8 g cu m. Type 2 fertilization is not favorable for phytoplankton growth. The beginning algal growth level is lower and this limits zooplankton growth; consequently, after fertilizer application, phytoplankton growth is reduced by zooplankton. Mean seasonal numbers and phytoplankton biomass were 19,000 cu cm and 9.4 g cu m, respectively. Two weeks after filling type 3 pond, the biocoenose was poisoned with 1.5 t ha liquid ammonia, killing 96% of the algae. However, phytoplankton revived quickly, after five days numbers exceeded those before poisoning. Thus, after toxicity removal, liquid ammonia acts as a fertilizer. Mean seasonal numbers were 185,000 cu cm and biomass, 24.5 g u m. In all ponds Chlorophyta is the dominant algae with Chlorella minutissima and Chlamydomonadaceae abundant. (Danovich-Wisconsin)
W80-00509

SIGNIFICANCE OF SORPTION PROPERTIES OF SOILS IN PREDICTING THE MIGRATION OF NITROGEN COMPOUNDS INTO NATURAL WATERS,
Technical Univ. of Warsaw (Poland), Dept. of Sanitary Environmental Engineering.
Z. Szperlinski, and K. Badowska.
Ekologia Polska, Vol 25, No 4, p 675-688. 1977. 11 fig, 2 tab, 15 ref.

Descriptors: *Ammonium compounds, *Nitrates, *Soil types, *Soil chemical properties, *Ion transport, Soils, Pedzols, Brown soils, Clay loam, Nutrient removal, Soil chemistry, Equations, Correlation analysis, Absorption, Adsorption, Fertilizers, Nitrogen compounds, Poland, Biochemistry, Laboratory tests.

This laboratory study on podzolic, black earth, and brown earth soils from around Warsaw and Plock, Poland, describes the role and significance of sorption and desorption soil properties in limiting migration of ammonium ions and nitrate ions from fertilized soils to underground waters due to rainfall. Ammonium desorption under influence of rainfall is only possible with light soils consisting of loose, weakly loamy sands with low ion-exchange capacity (4.0 mval (Ca+Mg)/100 g Dwt soil), clay fraction content (0.002mm), and organic matter content (2%). Ammonium ion desorption levels depend on soil sorption properties. Clay fraction content, ion-exchange capacity, and organic matter are exponentially correlated with ammonium ion desorption. Nitrate desorption under influence of rainfall occurs in all soil types. Desorption levels are limited due to nitrogen assimilation by crops and soil sorption properties. Clay fraction content correlates linearly with nitrate ion desorption. No relation was observed between organic matter content and ion-exchange capacity, and the distribution coefficient K-d or nitrate desorption levels. Equations are given which predict desorption and migration of nitrogen compounds from fertilized soils. Nitrogen ion desorption was examined under dynamic conditions in columns with soil fertilized with 200Kg/ha ammonium nitrate. Distilled water imitating 100 mm rainfall was the desorbing agent. (Danovich-Wisconsin)
W80-00510

METABOLISM OF TOXAPHENE BY AQUATIC SEDIMENT AND A CAMPHOR-DEGRADING PSEUDOMONAD,
Wisconsin Univ.-Madison. Dept. of Entomology.
J. M. Clark, and F. Matsumura.
Archives of Environmental Contamination and Toxicology, Vol 8, No 3, p 285-298. 1979, 5 Fig, 5

Tab, 20 ref.

Descriptors: *Pesticides, *Microbial degradation, *Pseudomonas, *Chlorinated hydrocarbon, *Lake Mendota, Wisconsin, Toxins, Organic compounds, Degradation(Decomposition), Biochemistry, Microbiology, Microorganisms, Aerobic bacteria, Aerobic conditions, Anaerobic conditions, Sediments, Insecticides, Animal physiology.

Aerobic processes are important in degrading toxaphene, a stable pesticide, in natural aquatic environments. Four aquatic sediment samples were collected from Lake Mendota, Wisconsin, and a bacterial strain, Pseudomonas putida, was selectively screened for its ability to utilize camphor as a sole carbon source. The significance of biologically complex organisms, such as pseudonomads, in pesticide degradation was studied. Degradation in incubated aquatic sediments of 14C-toxaphene proceeded faster under aerobic conditions in contrast to 36C1-toxaphene changed with in anaerobic conditions. Compositions of both 14C- and 36C1-toxaphene changed with reductions of apolar radioactivities and increased in more polar radioactivities at or near the origin. Enriched P. putida cell analysis demonstrated that the toxaphene metabolism aerobic route was more dominant, showing the importance of oxidative metabolism in degradation. P. putida aerobically produced 3.6 times more water-soluble radioactivities when anaerobically cultured. Aerobically incubated 36C1-toxaphene cultures also gave 2.3 times more soluble radioactivities than similarly cultured 14C-toxaphene samples, contrasting sediment experiment results where 36C1-toxaphene readily usable carbon source, more readily degraded 36C1-toxaphene than 14C-toxaphene. (Danovich-Wisconsin)
W80-00511

ALGAL BIOCHEMICAL TRICKS AND CLASSIFICATION,
Hawaii Univ., Honolulu. Sea Grant Coll. Program.
J. W. Hunt.
The American Biology Teacher, Vol 40, No 9, P 528-531. Dec. 1978. 1 Fig, 4 Tab, 6 Ref.

Descriptors: *Algae, *Education, *Cytological studies, *Classification, *Analytical technique, Training, Colleges, Universities, Cyanophyta, Chlorophyta, Rhodophyta, Phaeophyta, Aquatic algae, Marine algae, Plant physiology, Pigments, Plant pigments, Systematics, Biochemistry.

A proposed biology-teaching exercise used alone or with other methods, aids students learning through a discovery of basic algal classification concepts and scientific methods. The exercise utilizes four algal groups with which students most often come in contact: Chlorophyta (green), Cyanophyta (blue-green), Phaeophyta (brown), and Rhodophyta (red) for marine environments; and Chlorophyta and Cyanophyta for fresh-water environments. The main criteria in algal classification are: biochemical characteristics such as (1) nature of food reserves, (2) cell wall components (3) distribution and occurrence of photosynthetic pigments; and (4) structural characteristics, such as the nature of flagella; and (5) unique cellular details. Students may readily investigate biochemical algal characteristics through standard laboratory equipment, reagents, and simple tests, discovering similarities and dissimilarities of algae that suggested the classification scheme. Pigment content is determined through a combination of fat-soluble (acetone, methyl alcohol) or water-soluble pigment extracting agents. A color change of brown seaweed to green in 65 C hot water indicates the presence of fucoxanthin. Cell-wall compisition cause a solution of water and cleaned, dryed, and chopped red or brown seaweed to thicken when it is heated to boiling. Food storage products in Chlorophyta cause a bluish-to-blackish stain when IKI is applied. Other common reagents revealing algal cell structure are aniline blue and HC1. (Danovich-Wisconsin)
W80-00512

REDUCTION OF AQUATIC VEGETATION FOLLOWING THE COLONIZATION OF A NORTHERN SWEDISH LAKE BY THE MUSKRAT, ONDATRA ZIBETHICA,
Umea Univ. (Sweden). Dept. of Ecological Zoology.
K. Danell.
Oecologia, Vol 38, No 1, p 101-106, 1979. 3 Fig, 15 Ref.

Descriptors: *Muskrats, *Environmental effects, *Aquatic plants, *Animal growth, Rooted aquatic plants, Vegetation, Plant populations, Sweden, Lakes, Animal populations, Growth rates, Furbearers, Waterfowl.

Investigation of muskrat (Ondatra zibenthica (L.) impacts on stands of Equisetum, an emergent hydrophyte, in Sladan Lake, northern Sweden, found that mean open water areas per ha Equisetum were 26, 33, and 160 in 1970, 1973, and 1975, respectively. From 1970-1973, low muskrat densities removed one percent of Equisetum stands per year. In the summer of 1975, preceded by two high muskrat density winters, total open water areas increased to four percent. Infra-red photographs were randomly taken July 1970, 1973, and 1975 of 19 Equisetum ha after muskrats first appeared in 1963. Peak muskrat density is 3-6 animals per ha Equisetum. Equisetum standing crop is 0.3 kg Dw sq m and muskrat activity yielded very irregular open water areas. Muskrats influence habitats of dabbling ducks to the greatest extent by increasing edge areas between open water and emergent hydrophytes and increasing open water areas which contain submerged hydrophytes. Muskrats are regarded as a positive factor in waterfowl management. (Danovich-Wisconsin)
W80-00513

THE EFFECTS OF EMERGENCE AND SUBMERGENCE ON THE PHOTOSYNTHESIS AND RESPIRATION OF MARINE MACROPHYTES,
British Columbia Univ., Vancouver. Dept. of Botany.
A. Quadir, P. J. Harrison, and R. E. DeWreede.
Phycologia, Vol 18, No 1, p 83-88, 1979. 3 fig, 1 tab, 23 ref.

Descriptors: *Intertidal areas, *Photosynthesis, *Plant physiology, *Respiration, *Kelps, Dehydration, Tides, Water requirements, Metabolism, Marine algae, Habitats, Environment, Tidal effects, Drying, Canada, Stanley Park, British Columbia.

This study of emergent and submergent effects on gross photosynthesis and respiration rates for three intertidal algae collected in Stanley Park, British Columbia, Canada confirms that net photosynthetic activity is an important factor contributing to algal zonation. Iridaea cordata (low intertidal), Ulva fenestrata (low to mid-intertidal), and Fucus distichus (high intertidal) were collected at 0.9, 1.5, and 3.8 m, respectively, above the Canadian datum point. Evidence that Fucus is well adapted to its high intertidal zone was that net photosynthesis is maximum (6.2 mg CO2 gDw h) 20% dessication; only above 50% dessication does not photosynthesis decrease, and maximum gross photosynthesis, respiration, and net photosynthesis are greater for emerged than submerged thalli. Iridaea is better adapted for submergence than emergence: beyond a small water loss (10%) gross photsynthesis rapidly decreases while respiration stays constant; net photosynthesis reaches peak (4.0 mg C02 gDw h) at 10% dessication and beyond 30-40% dessication it became negative; maximum gross and net photosynthesis for submerged thalli are always greater than when emerged and respiration is less in submergence. Ulva is found between Iridaea and Fucus in the intertidal zone and its response in terms of net photosynthesis to emergence and submergence, is also intermediate when compared to these two algae. (Danovich-Wisconsin)
W80-00514

GROWTH AND COMPETITION OF THE MARINE DIATOMS PHAEODACTYLUM TRICORNUTUM AND THALASSIOSIRA PSEUDONANA, I. NUTRIENT EFFECTS,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
C. F. D'Elia, R. R. L. Guillard, and D. M. Nelson.
Marine Biology, Vol 50, No 4, p 305-312, 1979. 3 fig, 4 tab, 26 ref. N0AA04-6-158-44016.

Descriptors: *Diatoms, *Nutrient requirements, *Silica, *Competition, *Kinetics, Regression analysis, Phosphorus, Nitrogen, Nutrients, Sewage, Marine algae, Growth rates, Productivity, Primary productivity, Sewage effluents, Water types, Limiting factors, Cytological studies.

Batch culture experiments show that Phaeodactylum tricornutum enjoys considerable competitive advantage over Thalassiosira pseudonana in a waste water-seawater mixture not supplemented with silicon. This paper examines competition between T. pseudonana, a small centric diatom which is excellent bivalve food, and P. tricornutum, a small pennate diatom which is poor bivalve food, from nutritional requirements and allelopathic interaction aspects. P. tricornutum monocultures grew at constant, exponential rates (k=1.80) in sewage series for the first five days and final and highest cell densities were 1,930,000-4,450,000 cells ml. T. pseudonana monocultures achieved maximum cell density of 2,180,000 cells ml and grew best in treatments containing added Si. The waste water-seawater mixture had insufficient Si, relative to N and P, for the growth of T. speudonana. Under optimal conditions an estimated N:P:Si atomic ratio of 1:0:12:1 is required by T. pseudonana. P. tricornutum has no demonstrable Si requirement for cell division. No allelopathic interaction between the two species if detectable. In mixed cultures, T. pseudonana grows as rapidly as P. tricornutum in adequate Si supply. This study shows neither species outcompeting the other at k-max; however, outdoor continuous culture dilution rates are considerably less than k-max. (Danovich-Wisconsin)
W80-00515

THE DIATOMFLORA OF A SMALL STREAM NEAR ABISKO (SWEDISH LAPLAND) AND ITS ANNUAL PERIODICITY, JUDGED BY DRIFT AND COLONIZATION,
Umea Univ. (Sweden). Dept. of Biology.
A. Muller-Haeckel, and H. Hakansson.
Archisfur Hydrobiologie, Vol 84, No 2, p 109-217, November 1978. 12 fig, 3 tab, 31 ref.

Descriptors: *Diatoms, *Running waters, *Population, *Distribution, *Cycles, Sweden, Algae, Standing crops, Distribution patterns, Primary productivity, Biorhythms, Streams, Ecological distribution, Environmental effects, Chrysophyta, Plankton, Aquatic drift, Sessile algae.

In-situ sampling of drifting diatoms in Njakojokk stream near Abisko, Sweden, for 250 days from June 1975 to October 1976 demonstrates that diatoms have an innate annual activity pattern with two potential maxima, although environmental factors may modify the pattern. Njakojokk is three km long; water temperature does not exceed 15 C and is 0.1 C for the six coldest months, and water level is high in spring and low in summer and winter. Synedra minuscula, S. tenera, Diatoma elongatum, Meridion circulare, and Tabellaria flocculosa were dominant in plexiglass attachment; Achnanthes minutissima colonized plexiglass slides to a small degree compared with its drift abundance. Diatom colonization maximize annually in May-June and August-September. Synedra species have a high spring maximum and a lower one in August-September. Diatom elongatum have two isolated activity periods, disappearing around the month change in July-August. Annual patterns were more distinct and drifting and colonizing diatom quantities were greater in 1976 than 1975. At different sampling sites Diatoma elongatum showed flexibility in developing one or two maxima during the vegetation period and the highest may be in spring or autumn. (Danovich-Wisconsin)
W80-00516

PHYTOPLANKTON SUCCESSION IN NUTRIENT ENRICHED EXPERIMENTAL PONDS AS RELATED TO CHANGING CARBON, NITROGEN, AND PHOSPHORUS CONDITIONS,
Kansas Univ., Lawrence. Dept. of Botany.
F. DeNoyelles Jr., and W.J. O'Brien.

Archiv fur Hydrobiologie, Vol 84, No 2, p 137-165, November 1978. 6 fig, 5 tab, 48 ref.

Descriptors: *Phytoplankton, *Zooplankton, *Carbon, *Succession, *Nutrient requirements, *Productivity, Chemical analysis, Biomass, Primary productivity, Secondary productivity, Nutrients, Nitrogen,Phosphorus, Cyanophyta, Chrysophyta, Competition, Ecology, Growth rates, Population, Ponds.

Eight experimental ponds at Cornell University, Ithaca, NY studied 1968-1971, demonstrate that nutrient enrichment result in community biomass (222 mg chl a cu m) and productivity (630 mg C cu m/h) increases and in successional changes of the 51 species recorded. Changes in species composition are not only directly related to N and P levels but also to inorganic C availability. In original ponds, Chrysophytes and Cryptophytes such as Chrysochromulina parva, Dinobryon, Uroglenopsis americana, and Cryptomonas dominate. Other rare Chlorophyta and Cyanophta species including Pandorina morum Scenedesmus quadricauda, Sphaero-cystis Schroeteri, and Microcystis aeruginosa rise to dominance as N and P became more available. These species begin to dominate due to several advantages: high maximum growth rates with elevated nutrient concentrations and continued rapid C uptake as increased productivity changes original C availability conditions. Other minor advantages include resistence to grazing, greater buoyancy, and N-fixation. A fertilizer mixture of atomic ratio 22N:2.5P:1K was added at a rate of 53N:13P:6K micro g l d for low nutrient ponds and 281N:70P:32K micro g l d for high nutrient ponds. High nutrient ponds had inorganic N concentrations of 1-2 mg l and reactive P at 500 micro g l. Samples of the 0.1 ha (max. depth 1.22m) ponds were taken weekly spring and summer 1968, bimonthly in summer 1969, and less frequently during recovery phases to summer, 1971. (Danovich-Wisconsin)
W80-00517

PHYTOPLANKTON IN THE COASTAL WATERS OF THE BOTHNIAN BAY OFF KEMI,

Pohjos-Suomen Vesitutkimustoimisto, Oulu (Finland).
E. Alasaarela.
Annales Botanici Fennici, Vol 15, No 4, p 297-308, 1978. 6 fig, 2 tab, 41 ref.

Descriptors: *Phytoplankton, *Primary productivity, *Coasts, *Baltic sea, *Bay of Bothnia, Productivity, Biomass, Nutrients, Effluents, Waste water, Algae, Diatoms, Sewage effluents, Pulp wastes, Water quality, Environmental effects, Finland.

Phytoplankton production maximized late June 1976, along the coastal waters of the Bay of Bothnia in the northern Baltic Sea offshore of Finland and was dominated by Diatoma elongatum. Northern Bothnian Bay is characterized by river water discharges rich in humus but poor in nutrients. The coastal area off the town of Kemi, located at the mouth of Kemijoki River, is heavily influenced by domestic sewage and wood-processing effluents. Phytoplankton and environmental factors were surveyed in 1976. In April, river water with a 0.1% salinity formed a 2-4 m thick layer beneath the ice; salinity below river water was 3.3-3.4%. April oxygen saturation was 7-10 mg 02 1 in surface layers, 1-4 mg 02 1 near the bottom at polluted coasts, and 11-13 mg 02 1 at outermost bottom stations. Highest phosphate concentrations were measured in April, the lowest during summer (early) primary production maximum. Nitrate concentrations are highest in April (100-200 micro g l) and decline rapidly due to phytoplankton consumption after ice break-up. Early summer primary production maximum (104-283 mg C sq m d) occur in late June, a mid-summer minimum (9-18 mg C sq m d) in July, and a late summer maximum (83-210 mg C sq m d) in August. Mean chlorophyll a values are higher near Kemi (2.1-2.8 micro g l) than at outermost stations (1.4 micro g l). Highest values for total biomass,occur in polluted areas in July (3.8 mg/l). Annual production was highest near river inflow waters and lowest near acidic and toxic wood-processing mill wastes. (Danovich-Wisconsin)
W80-00518

EFFICACY, UPTAKE AND DISTRIBUTION OF DIFFERENT HERBICIDES IN THE WATER HYACINTH,

Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. for Phytomedicine.
S. P. Singh, and F. Muller.
Weed Research, Vol 19, No 1, p 1-8, February 1979. 2 fig, 3 tab, 10 ref.

Descriptors: *Herbicides, *2,4-D, *Plant physiology, *Pesticide residues, *Water hyacinth, *Aquatic weed control, Pesticide kinetics, Pesticide toxicity, Pesticides, Plant growth regulators, Path of pollutants, Toxins, Persistence, Tracers, Floating plants, Aquatic plants, Water pollution.

Experiments with water hyacinth plants (Eichhornia crassipes) grown in glass-house pots three hours after spraying with 2,4-D, reveals 42.9% of the herbicide on the plants and 53.3% in the water. Leaf blades and petioles lying above water receive 32.0% and 9.4%,respectively, and underwater parts, 1.5%. This paper compares behavior of two new herbicides, (asulam and glyphosate) with 2,4-D, studies distribution and persistence of 2,4-D and paraquat in plant-water systems, and investigates the role of roots and underwater plant parts in 2,4-D uptake and translocation. After 14 days, all plants were killed by 2,4-D. The 39.4% herbicide residue was distributed in dead plants (20.5% foliage 9.9% and roots 9.0%), and water (18.9%). Three hours after paraquat spraying 41.1% was present in water and 51.9% in plants (leaf blades 38.9%, petioles above water 8.8%, leaf blades and petioles under water 3.2%, and roots 0.9%). Three days after treatment, paraquat concentration increased in all plant components, underwater foliage doubled and roots trebled compared to the three hour interval. As time increased more herbicide accumulated in underwater parts from paraquat and 2,4-D. Uptake of 2,4-D increased with time, showing that water hyacinths can absorb and translocate the substance from treated water to result in their deaths if concentrations are greater than one ppm. With glyphosate at 2,4 and six kg a.i. ha, all plants were killed within three weeks. Asulam acted very slowly and hampered growth only for a short period at 2-6 kg a.i. ha rates without satisfactory water hyacinth control. (Danovich-Wisconsin)
W80-00519

APPLICATION OF THE AQUATIC MODEL CLEANER TO A STRATIFIED RESERVOIR SYSTEM,

New York State Dept. of Conservation, Albany, Office of Environmental Analysis.
B. Youngberg.
Center for Ecological Modeling Report No. 1, May 1977. 22 p, 34 fig, 1 tab, 25 ref, 2 append. EPA R 8050-47010, 6803-2142, NSF DEB 75-14168 A01.

Descriptors: *Model studies, *Simulation analysis, *Hydrologic data, *Biological properties, *Slapy Reservoir, Czechoslovakia, Nutrients, Biological communities, Reservoirs, Stratification, Epilimnion, Hypolimnion, Testing, Research and development, Computers, Physicochemical properties.

The major weakness of the 'CLEANER' simulation model is that hydrodynamic functions are too oversimplified; however, biological representations are realistic. If CLEANER were coupled to an adequately calibrated physical model, predictions might be more reliable. If sufficient driving-variable and circulation data were more available on several reservoir horizontal sections, the model would yield more realistic simulations. CLEANER is primarily a biological model originally used in completely mixed water systems. This study adapted CLEANER to more common stratified systems. The new CLEANER version uses data from Slapy Reservoir, Czechoslovakia, which is eutrophic, 42 km long, 300 m wide, and has a maximum depth of 53 m. It has been extensively studied for 15 years and data collected between 1959-1960 calibrated the model. The adapted model simulates for epilimnion and hypolimnion layers the following characteristics: phytoplankton, zooplankton, fish, dissolved inorganic nitrogen, phosphate, dissolved and suspended organic matter, dissolved oxygen, and decomposers. Sediment layers are represented by dissolved and particulate organic matter, dissolved inorganic nitrogen, phosphate, decomposers, and zoobenthos. The highest predicted blue-green algal concentration is close to the observed peak although predicted frequent algal oscillations do not actually occur. The model predicts diatom levels fairly well but zooplankton levels poorly. Due to model deficiencies in physical parameters, organism response to ambient conditions is not realistic. (Danovich-Wisconsin)
W80-00520

A MODEL FOR SIMULATING LAKE ECOSYSTEMS,

Rensselaer Polytechnic Inst., Troy, NY. Center for Ecological Modeling.
R. A. Park.
Center for Ecological Modelling, Report no. 3, March 1978, 19 p, 35 fig, 36 ref, 1 append.

Descriptors: *Model studies, *Lakes, *Testing, *Evaluation, Simulation analysis, Ecosystem, Prototype tests, Hydrologic data, Biological properties, Physicochemical properties, Hydraulic models, Research and development, Eutrophication, Projects, Quality control, Estimating.

Seven improvements have been developed for the ecosystem model 'CLEANER': (1) adaptive light and temperature constructs; (2) excess intracellular phytoplankton nutrient submodel; (3) provision for phytoplankton carbon limitation; (4) filter feeding construct refinements; (5) detailed sediment resuspension submodel; (6) light extinction dynamic function; and (7) simultaneous modeling capability for 10 horizontally- and vertically-linked lake segments. CLEANER was adapted to reservoirs, well-stratified lakes, shallow lakes, and high-mountain lakes and its applicability in eutrophication, fisheries management, and thermal pollution was tested. A sensitivity analysis procedure was developed, resulting in greater model evaluation. Nine European lakes were chosen as test sites according to data completeness, diverse lake characteristics, and research team qualifications. Efforts led to the development and verification of the original CLEANER, a comprehensive aquatic ecosystem model. In Slapy Reservoir, Czechoslovakia, the model demonstrates a maximum primary production level beyond which self-shading was limiting. In Loch Leven, Scotland, it suggests phosphate, nitrate, and silica could each be limiting. In several sites it predicts seasonal DO sag in hypolimnion and sediments with corresponding biological effects. It cannot correctly simulate Lake Balaton, Hungary, eutrophication because phosphate removal from marl formation is not modeled. CLEANER should not be applied to fish management problems without further testing. (Danovich-Wisconsin)
W80-00521

MATHEMATICAL MODELING OF PHYTOPLANKTON KINETICS WITH APPLICATION TO TWO ALPINE LAKES,

Rensselaer Polytechnic Inst., Troy, NY. Center for Ecological Modeling.
C. J. Desormeau.
Center for Ecological Modeling Report No. 4, May 1978. 21 p, 27 fig, 102 ref, 1 append. EPA R8050-47010, NSF DEB75-14168 A01.

Descriptors: *Model studies, *Simulation analysis, *Nutrients, *Phytoplankton, *Primary productivity, Lakes, Ecosystem, Testing, Biological properties, Physicochemical properties, Equations, Alpine, Subarctic, Kinetics, Growth rates, Nutrient requirements, Cycling nutrients, Light, Light intensity, Phototropism.

An internal nutrient submodel to 'MS CLEANER', an ecosystem model structured to simulate up to 20 biotic and 20 abiotic-state variables in each of 10 spatial lake segments simultaneously, is formulated to predict phytoplankton growth dynamics. Five process-level formations are incorporated: (1)

external nutrient uptake; (2) growth dependent on internal nutrient concentrations; (3) multiple-nutrient limitation based on threshold hypothesis; (4) light-dependent photorespiration; (5) adaptive light and temperature constructs affecting uptake, assimilation, excretion, respiration and photosynthesis. The phytoplankton growth model includes state-variable equations for phytoplankton, internal nitrogen, internal phosphorus, zooplankton, external nitrogen, and external phosphorus. Liebig's Law of the Minimum describes multiple-nutrient limitation. The model was calibrated for Ovre Heimdalsvatn, Norway, an ultra-oligotrophic, subarctic lake and was validated on Vorderer Finstertaler See, Austria, another ultra-oligotrophic alpine lake but quite dissimilar morphometrically and hydrologically. Vorderer Finstertaler See has a maximum depth of 28.5 m, 15.8 ha area, 2,330,000 cu m volume, and photosynthesis reaches lake bottom due to high water transparency. Ovre Heimdalsvatn has a 13 m maximum depth and 0.778 sq km surface area. (Danovich-Wisconsin)
W80-00522

FORAMINIFERA IN BRACKISH-WATER PONDS DESIGNED FOR WASTE CONTROL AND AQUACULTURE STUDIES IN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Geology.
A. LeFurgey, and J. St. Jean, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 105, Price codes: A02 in paper copy, A01 in microfiche. Journal of Foraminiferal Research, Vol. 6, No. 4, p 274-294, October 1976. 11 fig, 5 tab, 59 ref. NOAA 2-35178 and GH-78.

Descriptors: *Sewage effluents, *Protozoa, *Benthic fauna, Eutrophication, Ponds, Plankton, Sewage, Phytoplankton, Effluents, Aquiculture, Habitats, Microorganisms, North Carolina, Distribution, Biomass, Population, Speciation, Standing crops, Environmental effects, Calico Creek(NC), Bogue Sound(NC).

Effluent may not itself be lethal to foraminifera or deleterious to sedimentary environments but effluent in experimental ponds does not favor foraminifera success. This study determines how sewage effluent affects foraminifera species composition and diversity, standing crops, and seasonal and aeral distribution in six artificial ponds on Calico Creek and Bogue Sound, North Carolina. Each 0.1 acre pond with maximum depth less than one m, was constructed and began operation in late 1968; monthly sampling was initiated in fall 1970. Bogue Sound ponds simulate conditions of a well-flushed shallow marine lagoon typical of U.S. mid-Atlantic coast. Calico Creek ponds simulate a shallow marine marsh estuary polluted by secondary effluent discharged from a sewage treatment plant. Elphidium clavatum is the most common species in both effluent and control ponds. Species diversity is 20% higher and average living-foraminifera numbers are five times greater than effluent ponds. Standing crops in effluent ponds average 4.5 living specimens cc, in control ponds 23.7 living specimens cc. Estimated productivity is trebled in control ponds. Microenvironmental differences in oxygen, pH, and food supply make foraminiferal distribution erratic. Moderate summer photoplankton blooms occur in control ponds. In effluent ponds, dense winter phytoplankton blooms and concurrently low light levels, devastate original foraminifera populations, creating fluctuating foraminifera ecological significance. (Danovich-Wisconsin)
W80-00523

TIME SERIES ANALYSIS OF AMMONIA IN THE PASSAIC RIVER,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
T. J. Olenik.
Progress in Water Technology, Vol. 8, No. 4-5, p 237-251, 1977. 6 fig, 6 tab, 9 ref.

Descriptors: *Passaic River(NJ), *Time series analysis, *Ammonia, *Nitrogen, *Statistical models, *Stochastic processes, Rivers, New Jersey, Nutrients, Eutrophication, Algae, Model studies, Water quality standards, Water pollution control, ARIMA model, Methodology, Forecasting, Analytical techniques.

A time series analysis method based on Box and Jenkins (1970), and incorporating the autoregressive integrated moving average model (ARIMA), was used on ammonia-nitrogen data for the Passaic River of northern New Jersey to answer the question of whether or not the ammonia concentration is strictly deterministic or might have additional stochastic characteristics. Water quality and effluent standards have been based on deterministic water quality testing (including waste discharges) and on the resulting mathematical models, but it is becoming increasingly obvious that data and standards should be based on a stochastic model. The 12-month moving average technique used in this study showed somewhat of a long-term trend of ammonia-nitrogen and nitrate-nitrogen data, but there was a great deal of variability. Conclusions: (1) ammonia-nitrogen data analyzed is randomly distributed in time and correlated to some extent in space; (2) lack of fundamental interaction among weekly data shows further the randomness of the data, suggesting also that contributions of upstream treatment plants to ammonia-nitrogen is small; and (3) had there been available distinct daily readings for ammonia-nitrogen the modelling techniques would have been much more effective. At present no significant nitrification or algal growths in the river have been reported, a condition traceable to stream flow characteristics and the lack of direct agricultural runoff. (Lynch-Wisconsin)
W80-00638

A HISTORY OF MERCURY LEVELS IN SWEDISH FAUNA,
Naturhistoriska Riksmuseet, Stockholm (Sweden). Section for Invertebrate Zoology.
For primary bibliographic entry see Field 5A.
W80-00649

A SEASONAL SURVEY OF FISH POPULATIONS IN THE LOWER MEDWAY ESTUARY, KENT, BASED ON POWER STATION SCREEN SAMPLES,
City of London Polytechnic (England). Dept. of Biological Sciences.
W. L. F. van den Broek.
Estuarine and Coastal Marine Science, Vol. 9, p 1-15, 1979. 5 fig, 1 tab, 33 ref, append.

Descriptors: *Seasonal, *Fish populations, *Powerplants, *Intakes, Cooling water, Sampling, Dominant organisms, Entrainment, Statistical analysis, Mathematical models, Methodology, Medway Estuary, Kent, England, *Species diversity.

Quantitative samples were collected from the cooling-water intake screens at Kingsnorth Power Station between May 1973 and August 1975. The sampling method is discussed and the catch compared with trawl samples taken in the vicinity. A total of 46,228 fish, 49 species and weighing 325.0 kilograms were taken in 39 screen samples. Numerically the monthly samples were dominated by Sprattus sprattus (L.) and twelve other species which together formed more than 90% of the catch in most months. Short-term fluctuations in catch were marked but superimposed on this was a clear seasonal cycle; numbers of species, numbers of individuals and total weights of catch reached maxima in winter and minima in summer. The three diversity indices measured displayed no definite seasonal pattern, the result of fluctuations in sprat numbers. (Deal-EIS)
W80-00650

THE RESPONSE OF COHO SALMON AND GUPPIES TO 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD) IN WATER,
Pacific Northwest Forest and Range Experiment Station, Corvallis, OR. Forestry Sciences Lab.
For primary bibliographic entry see Field 5A.
W80-00651

THERMAL SHOCK RESISTANCE OF SPOT (LEIOSTOMUS XANTHURUS) AFTER ACCLIMATION TO CONSTANT OR CYCLING TEMPERATURE,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
S. I. Hartwell, and D. E. Hoss.
Transactions of the American Fisheries Society, Vol. 108, p 397-400, 1979. 1 fig, 24 ref.

Descriptors: *Heat resistance, *Fish physiology, *Water temperature, Bioassay, Thermal stress, Growth stages, Juvenile growth stage, Mortality, Thermoperiodism, Biorhythms, Lethal limit, *Spot, *Leiostomus.

Postlarval and juvenile spots were acclimated to selected constant temperatures and to diel temperature cycles. Following acclimation they were exposed to temperature shocks from 0 C (control) to 20 C above acclimation temperatures. Twenty-four-hour median lethal shock temperatures (LS50 values) were calculated by probit analysis. The temperature cycles used had no apparent effect on the thermal shock resistance of either postlarval or juvenile spots relative to constant-temperature acclimation. When acclimated at the same temperatures, post-larvae had lower thermal shock resistances than juveniles. Most mortality occurred within 10 minutes of shock onset. (Deal-EIS)
W80-00652

ACCLIMATION TO AMMONIA BY TILAPIA AUREA,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 5A.
W80-00653

GROWTH RATES AND TEMPERATURE SELECTION OF BLUEGILL, LEPOMIS MACROCHIRUS,
Wisconsin Univ.-Madison. Lab. of Limnology.
T. L. Beitinger, and J. J. Magnuson.
Transactions of the American Fisheries Society, Vol. 108, p 378-382, 1979. 1 tab, 44 ref.

Descriptors: *Growth rates, *Thermal stratification, *Sunfishes, Fish diets, Juvenile growth stage, Size, Weight, Fish physiology, Water temperature, Habitats, Fish behavior, Thermal stress, Aquiculture.

Growth rates of individual juvenile bluegills fed 0.75, 2.0, 4.0, and 6.0% dry body weight/day and ad libitum at constant temperatures were smaller above (34 C) than within (30 or 31 C) or below (25 and 28C) this species' preferred temperature range. For each feeding regime growth rate did not differ significantly at temperatures below 34 C. (Deal-EIS)
W80-00654

THE SURVIVAL OF SMOLTS OF SALMON SALMO SALAR L. AT LOW CONCENTRATIONS OF DISSOLVED OXYGEN,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 5A.
W80-00655

TOTAL AND METHYLMERCURY LEVELS IN THREE SPECIES OF WHELKS,
Shimonoseki Univ. of Fisheries (Japan). Dept. of Food Science and Technology.
For primary bibliographic entry see Field 5A.
W80-00656

TRACE METALS IN SEADUCKS OF THE FRASER RIVER DELTA INTERTIDAL AREA, BRITISH COLUMBIA,
Canadian Wildlife Service, Delta (British Columbia).
For primary bibliographic entry see Field 5A.
W80-00657

THE CONCENTRATION AND SPECIATION OF ARSENIC IN MARINE MACRO-ALGAE,
Skidway Inst. of Oceanography, Savannah, GA.

For primary bibliographic entry see Field 5A.
W80-00658

ELECTRIC FISH AS A TOOL FOR WATER QUALITY ASSESSMENT,
City Coll., New York.
For primary bibliographic entry see Field 5A.
W80-00659

SENSITIVITY OF ALASKAN FRESHWATER AND ANADROMOUS FISHES TO PRUDHOE BAY CRUDE OIL AND BENZENE,
National Marine Fisheries Service, Auke Bay, AK. Auke Bay Lab.
For primary bibliographic entry see Field 5A.
W80-00660

EFFECTS OF BOTTOM SEDIMENTS ON THE SURVIVAL OF ENTEROBACTER AEROGENES IN SEAWATER,
Chinese Univ. of Hong Kong. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-00662

EFFECTS OF ORAL ADMINISTRATION OF CADMIUM ON FISH-V EFFECTS ON CALCIUM AND INORGANIC PHOSPHORUS EXCRETION IN THE CARP,
Kyushu Univ., Fukuoka (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 5A.
W80-00663

EFFECTS OF KUWAIT OILS ON FEEDING RATES OF COPEPODS,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
For primary bibliographic entry see Field 5A.
W80-00666

MEASUREMENT OF COMPLEXING MATERIALS EXCRETED FROM ALGAE AND THEIR ABILITY TO AMELIORATE COPPER TOXICITY,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 5A.
W80-00667

PHOTOOXIDATION PRODUCTS OF A FUEL OIL AND THEIR ANTIMICROBIAL ACTIVITY,
Academy of National Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
For primary bibliographic entry see Field 5B.
W80-00671

NEPHROCALCINOSIS IN RAINBOW TROUT SALMO GAIRDNERI RICHARDSON; THE EFFECT OF EXPOSURE TO ELEVATED CO2 CONCENTRATIONS,
Shearwater Fish Farming Carlisle (England).
For primary bibliographic entry see Field 5A.
W80-00674

HEPATOMAS IN ATLANTIC TOMCOD MICROGADUS TOMCOD (WALBAUM) COLLECTED IN THE HUDSON RIVER ESTUARY IN NEW YORK,
Fish and Wildlife Service, Bozeman MT. Fish Cultural Development.
For primary bibliographic entry see Field 5B.
W80-00675

THE EFFECT OF CADMIUM AND LEAD ON THE GROWTH OF TWO SPECIES OF MARINE PHYTOPLANKTON WITH PARTICULAR REFERENCE TO THE DEVELOPMENT OF TOLERANCE,
Queen Mary Coll., London (England). Dept. of Zoology and Comparative Physiology.
For primary bibliographic entry see Field 5A.
W80-00676

EFFECTS OF TREATED EFFLUENT ON A NATURAL MARSH,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W80-00677

REDUCTION OF NONIONIC SURFACTANT TOXICITY BY SECONDARY TREATMENT,
Procter and Gamble Co., Cincinnati, OH.
For primary bibliographic entry see Field 5A.
W80-00678

ACUTE TOXICITY OF COPPER, CADMIUM AND ZINC TO THREE SPECIES OF MARINE COPEPOD,
Victoria Ministry for Conservation, Melbourne (Australia). Marine Pollution Studies Group.
For primary bibliographic entry see Field 5A.
W80-00679

UNEXPECTED RESPONSE TO VITAMIN B12 OF DOMINANT CENTRIC DIATOMS FROM THE SPRING BLOOM IN THE GULF OF MAINE (NORTHEAST ATLANTIC OCEAN),
Rhode Island Univ., Kingston. Graduate School of Oceanography.
D. G. Swift, and R. R. L. Guillard.
Journal of Phycology, Vol. 14, No. 4, p 377-386, December 1978. 5 fig, 6 tab, 40 ref. NSF GB 33288.

Descriptors: *Diatoms, *Plant physiology, *Growth rates, *Algal growth potential, *Nutrient requirements, Gulf of Maine, Atlantic Ocean, Northeast US, Eutrophication, Plant growth substances, Bioassay, Cycling nutrients, Metabolism, Nutrients, Environmental effects, Biochemistry, Physiological ecology, Laboratory tests, Analytical techniques.

Twelve isolated clones of dominant centric-diatom spring bloom species taken from the Gulf of Maine in April 1968 have no absolute vitamin B12 requirement but respond to B12 in an ecologically significant manner by increased growth rate and decreased lag time. This behavior is inherent in algal physiology and not due to detectable contaminants. Water samples were taken from three stations and enrichment cultures and culture tubes were kept in an illuminated incubator at five C. Genera included were Thalassiosira, Porosira, and Chaetoceros. T. nordenskioelkii, T. rotula, T. aestivalis, and C. concavicornis had higher growth rates with B12 present and reached a bloom population density sooner. T. aestivalis with B12 present showed a 16-day lag and then grew with a 3.4 day doubling time. The vitamin-free culture showed a 30-day lag and 6.3 day doubling time, requiring 54 more days to grow to the bloom density. Some clones removed more than 80% of the vitamin (5 ng B12/l) from the medium. When grown in vitamin-free medium, cells returned 0.01-0.7 ng B12 1 into the medium. Formation of auxospores occurred independently of the presence or absence of B12. The isolated species behaved as B12 auxotrophs with the ability to synthesize their own supply if necessary. The B12 stimulation might allow facultative autotrophic diatoms to compete well with auxotrophic diatoms at the beginning of a bloom. (Danovich-Wisconsin)
W80-00681

THE EFFECT OF ZINC ON THE INCREASE IN LENGTH OF FIVE SPECIES OF INTERTIDAL FUCALES,
Trondheim Univ. (Norway).
For primary bibliographic entry see Field 5B.
W80-00682

THE ROLE OF MELANO-MACROPHAGE CENTRES IN IRON STORAGE IN NORMAL AND DISEASED FISH,
Stirling Univ. (Scotland). Unit of Aquatic Pathobiology.
For primary bibliographic entry see Field 5A.
W80-00683

PHYTOPLANKTON IN THE FOX CHAIN OF LAKES,
Illinois State Water Survey Peoria.
S. D. Lin, R. L. Evans, and D. B. Bruscher.
Water Resource Bulletin, Vol. 15, No. 4, p 974-983, 1979. 3 fig, 2 tab, 10 ref.

Descriptors: *Phytoplankton, *Lakes, *Illinois, *Distribution patterns, Aquatic algae, Water quality, Cyanophyta, Chlorophyta, Diatoms, Dominant organisms, Eutrophication, Aquatic populations, Trophic level, *Flagellates, *Desmids.

As part of a comprehensive water quality investigation on the Fox Chain of Lakes during May to October 1975, water samples from the Chain and Cedar Lake (reference) at 25 locations were collected weekly or bi-weekly to determine the species and densities of algae. The results have been evaluated for algal composition, density, and succession for each location. Sixty-four algal species were recovered from 414 samples. The number of species per sampling location varied from 10 at Channel Lake and Lake Marie to 26 on Fox Lake (main) and Grass Lake. Blue green algae were predominant and occurred at 25 of the 25 sampling stations. They consisted mainly of Aphanizomenon flos-aquae. The only flagellate of importance was Ceratium hirundinella, and significant concentrations of this organism were limited to Channel Lake and Lake Catherine. The only green alga bloom was created by Ulothrix variabilis on the waters of Pistakee Lake. Diatoms were quite significant on the shallower water bodies. (Deal-EIS)
W80-00686

CONCENTRATION AND SOURCES OF FECAL AND ORGANIC POLLUTION IN AN AGRICULTURAL WATERSHED,
Allen County Soil and Water Conservation District, Fort Wayne, IN.
For primary bibliographic entry see Field 5A.
W80-00687

SOME OBSERVATIONS ON POLLUTANTS OF VELSAO BAY (GOA),
National Inst. of Oceanography, Goa (India).
For primary bibliographic entry see Field 5A.
W80-00688

ANALYSIS OF TOXICITY DATA FOR CALIFORNIA MARINE WATER QUALITY STANDARDS,
California State Water Resources Control Board, Sacramento.
L. A. Klapow, and R. H. Lewis.
Journal of the Water Pollution Control Federation, Vol. 51, p 2054-2070, 1979. 6 fig, 2 tab, 19 ref.

Descriptors: *Water quality standards, *California, Water quality control, Ammonia, Toxicity, Chlorine, Heavy metals, Polychlorinated biphenyls, Phenols, Pesticide residues, Chlorinated hydrocarbon pesticides, Sea water, Bioindicators, Chemical wastes, Industrial wastes, Water chemistry, Chemical analysis, Coasts, Bioassays, *Bioaccumulation, *Tissue analysis.

The literature on the toxicity of a number of wastewater constituents toward aquatic life was reviewed and summarized. The constituents included toxicologically important heavy metals, cyanide, phenolics, chlorine, ammonia, chlorinated pesticides, and polychlorinated biphenyls. Reported seawater background concentrations for trace metals and ammonia also were summarized. Estimates were made of acute and chronically toxic thresholds for sensitive aquatic organisms and of average background concentrations of potentially toxic materials that occur naturally in sea water. Concentration estimates were analyzed to yield suitable marine water quality standards. (Deal-EIS)
W80-00689

THE EFFECTS OF POLLUTION-INDUCED OXYGEN DEFICIENCY ON THE BENTHOS IN ELEFSIS BAY, GREECE,
Environmental Pollution Control Project, Athens (Greece).

A. J. Zarkanellas.
Marine Environmental Research, Vol. 2, p 191-207, 1979. 2 tab, 5 fig, 42 ref.

Descriptors: *Seasonal, *Dissolved oxygen, *Benthic fauna, *Sediment, *Diversity indices, Species diversity, Benthos, Distribution patterns, Oxygenation, Sampling, Elefsis Bay(Greece), Oxygen, Water quality, On-site investigations, Water pollution effects, Water pollution sources, Analytical techniques, Industrial wastes, Sewage.

Benthic studies in Elefsis Bay, Greece, have shown pronounced seasonal changes in both numbers of species and of individuals. In both winter and summer, abundance and diversity were higher in the western than in the eastern part of the Bay. In summer, abundance and diversity increased in the former and sharply decreased or dropped to zero in the latter. In summer most of the bottom, with an oxygen concentration of less than 1 ml/litre, became almost azoic. With increasing oxygen concentration the numbers of species and individuals increased. The most abundant and frequent winter species were found in summer in reduced numbers at a limited number of stations, all of which were characterized by an oxygen concentration higher than 1 ml/litre. Dominance diversity (H'), as measured by the Shannon-Werner formula, and its species diversity component (d), showed wide differences both spatially and temporally, which coincided with the dissolved oxygen regimes in the Bay. The evenness component (J') did not seem to be a reliable 'weighting factor' of H' when numbers of species and individuals were low, thus necessitating caution in its use. The values of H', J' and d were compared with those of other areas divided into pollution zones based on purely faunistic data. Using the results of these comparisons, Elefsis Bay was divided into pollution zones which, from two in winter (subnormal and polluted), increased to three in summer when an azoic zone was formed. (Katz-EIS)
W80-00690

ENVIRONMENTAL ASSESSMENT OF AN ACTIVE OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO 1977-1978. VOLUME III: CHEMICAL AND PHYSICAL INVESTIGATIONS.
National Marine Fisheries Service, Galveston, TX. Southeast Fisheries Center.
Annual Report to EPA, September 1979. 710 p. William B. Jackson (Ed). EPA-IAG-D5-E693-EO.

Descriptors: *Water pollution effects, *Oil fields, *Ecosystems, Heavy metals, Environmental effects, Path of pollutants, Model studies, Gulf of Mexico, Pollutant identification, *Outer Continental Shelf, Hydrocarbons, Buccaneer Oil Field.

Volume III of a three volume annual report contains detailed scientific and technical information on the results of chemical and physical investigations of the operating Buccaneer Oil Field off Galveston, Texas. The tasks of the various work units are as follows: To identify and document the extent and types of biological, chemical, and physical alterations in the marine ecosystem that are associated with the development of and production of discharges from an oil field; to describe the fine sediments and nepheloid layer of the oil field, focusing upon their relationship to heavy metal adsorption; to determine levels, pathways, and bioaccumulation of heavy metals; to describe seasonal circulation patterns in the oil field; to determine the specific pollutants, their quantity and effects on the various components of the marine ecosystem; to determine levels, pathways, and bioaccumulation of selected discharge constituents (non-metals) in the marine ecosystem in the oil field; and to construct a hydrocarbon model. (NOAA)
W80-00692

THE IMPACT OF DREDGED HOLES ON OXYGEN DEMAND IN THE LOWER BAY, NEW YORK HARBOR,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 4C.
W80-00694

CHEMICAL POLLUTANTS OF THE NEW YORK BIGHT; PRIORITIES FOR RESEARCH,
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
Project Report, June 1979. J. S. O'Conner and H. M. Stanford (Eds.). 227 p, 3 fig, 37 tab, 374 ref, 5 append.

Descriptors: *Water quality, *Water pollution effects, *Pollutant identification, Path of pollutants, Oil pollution, Heavy metals, Chemical analysis, Priorities, New York Bight, Chemical pollutants.

The New York Bight Marine EcoSystems Analysis (MESA) Project of the National Oceanic and Atmospheric Administration (NOAA) is an eight-year interdisciplinary field program involving studies of the New York Bight and of the effects of human influences on this ecosystem. The specific objective of the Project is to determine the fates and effects of contaminants in the New York Bight. The MESA Project sought guidance from a panel of experts to identify the contaminants that are, or may become, the most serious problems in the Bight. This report presents the findings of the investigation. The main text presents the conclusions of the several subpanels, and appendices present detailed data. A single list of references directs the reader to the literature on which the Panel based its findings. The conclusions of the Panel with respect to contaminants of the New York Bight are based on information available in June 1977. The report is intended to encourage other researchers to help quantify the distribution of the contaminants. (NOAA)
W80-00697

A SURVEY OF THE BIOTA, ENVIRONMENT AND USE FOR RECREATION OF TWELVE LAKES IN SNOWDONIA,
University Coll. of North Wales, Bangor. School of Plant Biology.
M. J. Liddle, C. M. Happey-Wood, and A. Buse.
Biological Journal of the Linnean Society, Vol. 11, No. 1, p 77-101, February 1979. 9 fig, 57 ref, 9 append.

Descriptors: *Classification, *Biological communities, *Water chemistry, *Lake morphometry, *Size, Oligotrophy, Invertebrates, Phytoplankton, Water pollution, Recreation, Lakes, Wales, Statistics, Mathematical studies, Lake morphology, Areal, Bioindicators, Physicochemical properties, Indicators, Correlation analysis, United Kingdom.

Twelve lakes intensively used for recreation in Snowdonia, northwestern Wales, were surveyed June and July 1973 to examine possible associations between biota and physical/chemical environments; lake size, as well as chemistry, had important effects on biota. The lakes are all oligotrophic; however, three larger ones contain high nitrogen concentrations. Macrophyte species include Potamogeton natans, Phalaris arundinacea, and Phragmites. Carex rostrata and Isoetes species are always present; Lobelia dortmanna and Litorella uniflora form extensive carpets in some lakes. Phytoplankton species such as Chlamydomonas Grovei, Dinobryon divergens, Ceratium hirundinella, and diatoms Asterionella formosa and Tabellaria flocculosa occur. Larger invertebrates range from chironomid larvae to Limnophilidae. Smaller lakes are associated with three desmids indicator species Arthrodesmus octocornis, Euastrum elegans, and Staurastrum polymorphum while Dinobryon divergens is associated with larger lakes. Principal environmental variables are lake size, conductivity, alkalinity, nitrogen concentration, light extinction coefficients and macrophyte vegetation quantity. Greater emphasis on physical environments, especially lake size, is important when comparing oligotrophic lakes of similar chemistry. If recreation is allowed to increase, biota in smaller lakes would be degraded by pollution such as increasing campers causing increasing sewage, and by mechanical damage to macrophytes by boating. (Danovich-Wisconsin)
W80-00699

A MATHEMATICAL ECOSYSTEM MODEL APPLICABLE TO SHALLOW WATER BODIES,
Deutsche Akademie der Wissenchaften zu Berlin (German D.R.). Inst. fuer Geographie and Geookologie.
For primary bibliographic entry see Field 2L.
W80-00711

A SIMPLE EUTROPHICATION MODEL FOR THE BAY OF KESZTHELY, LAKE BALATON,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 2L.
W80-00712

MODELLING OF THE EUTROPHICATION PROCESS IN LAKES AND RESERVOIRS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 2H.
W80-00718

THE USE OF THE SALINITY MAXIMUM OF THE EQUATORIAL UNDERCURRENT FOR ESTIMATING NUTRIENT ENRICHMENT AND PRIMARY PRODUCTION IN THE GULF OF GUINEA,
Office de la Recherche Scientifique et Technique Outre-Mer, Abidjan (Ivory Coast). Centre de Recherches Oceanographiques.
B. Voituriez, and A. Herbland.
Deep-Sea Research, Vol. 26A, No. 1, p 77-83, January 1979. 5 fig, 14 ref.

Descriptors: *Mathematical studies, *Salinity, *Currents(Water), *Nitrates, *Mixing, *Gulf of Guinea, Atlantic Ocean, Nutrients, Primary productivity, Productivity, Chemical stratification, Equations, Oceans, Physical properties, Chemical properties, Water properties, Sea water, Destratification, Water circulation.

Primary production is related to the equatorial undercurrent salinity maximum in the Gulf of Guinea, and because vertical mixing is responsible for equatorial surface enrichment in the Atlantic Ocean, similar relationships between nitrate enrichment, nitracline depth, primary production, and salinity maximum of the undercurrent should be valid for each longitude. This mathematical study presents equations explaining that vertical mixing variations account for summer disappearance of the salinity maximum in the Gulf of Guinea and its strong decrease along the equator from west to east in the summer. Data from cruises of the R.V. Jean Charcot and Capricorne around longitude 4 W from 1973-1977 were used. Production maximum occurs June to September, decreases October to January, and is at minimum in spring. A low nitrate content of 200 mg at sq m is associated with highest observed salinity (36.43%) and undercurrent speed of 100 cm sec, which is unusually high. In tropical areas, primary production is controlled by the nitracline position in the euphotic layer, therefore, nitracline depth is both a measure of light intensity and, indirectly, primary production. The top nitracline depth results from an equilibrium of physical processes such as vertical advection and mixing, and nitrate uptake by phytoplankton. Thickness of the nitrate depleted layer is defined by depth of the maximum stability layer through which little nitrate diffuses and in turn indicates the amount of vertical mixing. (Danovich-Wisconsin)
W80-00781

A MORPHOMETRIC STUDY OF LEAD AND COPPER EFFECTS ON DIATOMA TENUE VAR. ELONGATUM (BACILLARIOPHYTA),
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 5A.
W80-00782

COMPARISON OF ANESTHETIC POTENCY OF BENZOCAINE HYDROCHLORIDE AND

MS-222 IN TWO FRESHWATER FISH SPECIES,
Randse Afrikaanse Univ., Johannesburg (South Africa). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-00784

TOXICITY OF FISHERY CHEMICALS TO THE ASIATIC CLAM, CORBICULA MANILENSIS,
Fish and Wildlife Service, Warm Springs, GA. Southeastern Fish Control.
For primary bibliographic entry see Field 5A.
W80-00785

CARBONIC ACID ANESTHESIA FOR AQUATIC ORGANISMS,
Colorado State Univ., Fort Collins. Dept. of Fishery and Wildlife Biology.
For primary bibliographic entry see Field 5A.
W80-00786

INTERACTIVE EFFECTS OF SALINITY, TEMPERATURE AND POLYCYCLIC AROMATIC HYDROCARBONS ON THE SURVIVAL AND DEVELOPMENT RATE OF LARVAE OF THE MUD CRAB RHITHROPANOPEUS HARRISII,
Texas A and M Univ., College Station. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-00790

RESPONSES OF MARINE FOULING COMMUNITIES TO SEWAGE ABATEMENT IN KANEOHE BAY, OAHU, HAWAII,
Research Corporation of the University of Hawaii, Honolulu.
For primary bibliographic entry see Field 5B.
W80-00791

EFFECTS OF ARTIFICIAL EUTROPHICATION ON THE METABOLISM OF THE JAPANESE OYSTER CRASSOSTREA GIGAS,
Tohoku Univ., Sendai (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 5B.
W80-00792

THE ROCK OYSTER SACCOSTREA GLOMERATA AS AN INDICATOR OF TRACE METALS IN HONG KONG,
Fisheries Research Station, Aberdeen (Hong Kong).
For primary bibliographic entry see Field 5A.
W80-00793

THE USE OF CHIRONOMID PUPAL EXUVIAE IN THE SURVEILLANCE OF SEWAGE POLLUTION WITHIN A DRAINAGE SYSTEM,
Bristol Univ. (England). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-00794

CHRONIC TOXICITY OF VANADIUM TO FLAGFISH,
Guelph Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-00795

SURVEY OF THE POLLUTION IN A COASTAL AREA OF THE TYRRHENIAN SEA. AERIAL PHOTOGRAPHY, PHYSICO-CHEMICAL AND MICROBIOLOGICAL INVESTIGATIONS AND MUTAGENIC MONITORING,
Genoa Univ. (Italy). Inst. of Hygiene.
For primary bibliographic entry see Field 5A.
W80-00796

TOXIC EFFECTS OF AQUEOUS EXTRACTS OF EKOFISK CRUDE OIL, CRUDE OIL FRACTIONS, AND COMMERCIAL OIL PRODUCTS ON THE DEVELOPMENT OF SEA URCHIN EGGS,
Tromoe Univ. (Norway). Inst. of Biology and Geology.
For primary bibliographic entry see Field 5A.
W80-00798

THE EFFECTS OF CHANNELIZATION ON FURBEARERS AND FURBEARER HABITAT,
Mississippi State Univ., Mississippi State.
M. H. Gray, and D. H. Arner.
Proceedings of the Thirty-First Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, Vol. 31, p 259-265, 1977. 7 tab, 7 ref.

Descriptors: *Channel improvement, *Habitats, *Furbearers, Channeling, Beavers, Minks, Muskrats, Dominant organisms, Animal populations, Stream improvement, Wildlife habitats, Luxapalila River, Mississippi, Alabama.

Biological data were collected over a 3 year period (1974-1977) from an old channelized segment (55 years), an unchannelized segment and a newly channelized segment (4 years) of the Luxapalila River in Mississippi and Alabama. This study revealed that furbearer habitat in the channelized segments has not recovered to the level exhibited in the unchannelized segment. Indices of furbearer abundance were obtained by night lighting and sign counting. Beaver (Castor canadensis), mink (Mustela vison), muskrat (Ondatra zibethicus), and raccoon (Procyon lotor) were more numerous in the unchannelized segment than in either the old or newly channelized segments. (Deal-EIS)
W80-00800

5D. Waste Treatment Processes

DRINKING WATER SUPPLY - A FIELD FOR UNICEF ASSISTANCE.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, Pergamon Press, 1978. Vol. 1, part 2, p 847-856.

Descriptors: *United Nations Children's Fund, *Water resources development, *Sanitation, *Water supply, *Financing, *Potable water, Grants, United Nations, Rainwater, Wells, Stream, Springs, Water sources, Social participation, Training, Public health, Developing countries, Groundwater, Education.

Safe water and sanitation at the village level is basic to all maternal and child health work, and has a direct bearing of child morbidity and mortality and on the economic and social welfare of the community. UNICEF provides assistance for installation of wells, gravity systems, and related needs, and emphasizes training, integration of health education and water supply schemes, community participation in all phases of a project, and planning for subsequent operation and maintenance. Some 10-15% of total UNICEF allocations are spent on water supply and sanitation (US $13.5 million in 1975). Over 80 of 112 countries in which UNICEF is active currently receive such aid. Projects range from pilot or demonstration projects to substantial contributions to large government programs. Groundwater is usually tapped through dug or drilled wells; the latter are preferred in terms of sanitation and speed. Mountain streams and capped springs are a source of water in parts of Asia and Africa, and some areas with no other water resources make use of rainwater catchments. Pilot villager education projects have been funded in India, UNICEF assistance takes the form of equipment, materials, and funds. The government is usually expected to make a significant contribution to the project, and to assume responsibility for maintenance. (Lynch-Wisconsin)
W80-00420

MAIN TRENDS IN TREATMENT OF MUNICIPAL AND INDUSTRIAL SEWAGE IN THE USSR,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
S. A. Schubert, S. V. Yakovlev, and I. Y. Rubchak.
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2163-2178.

Descriptors: *Soviet Union, *Sewage treatment, *Industrial wastes, *Municipal wastes, *Methodology, *Waste water treatment, Sludge treatment, Water pollution control, Governments, Recycling, Biological treatment, Chemical treatment, Water purification, Reagents, Flotation, Hyperfiltration, Filtration, Desalinization, Ion exchange, Oxidation, Chlorine, Ozone, Flocculation, Organic matter, Sorption.

Biological treatment is the predominant traditional Soviet treatment method for municipal and most industrial sewage containing organic contaminants in dissolved and colloidal states. Research is underway on use of biological agents to intensify treatment, employing symbiotic sludge structures, specific microorganisms, biochemical stimulants, and mutagenesis. Pretreatment improvements involving forced separation of slurries include open and pressure hydrocyclones and bowl centrifuges. Post-treatment facilities are used to supplement biological treatment at municipal purification plants and at certain large industrial enterprises. For both municipal and industrial sewage treatment local and central facilities are combined to ensure technological and economic optimization. Chemical treatments commonly include reagents and flocculants. Flotation and hyperfiltration are also used to extract contaminants from sewage; hyperfiltration, electrodialysis and ion exchange are used for desalinization. Extensive use is made of filters. Complete removal of dissolved organic matter from sewage is effected by sorption on powdered and granular sorbents. Among physicochemical methods, oxidative processes with active chlorine, chlorine dioxide, and ozone, and important. Sludge treatment typically includes concentration, stabilization of the organic portion, conditioning, dehydration, and product use or waste disposal. (Lynch-Wisconsin)
W80-00464

MICROBIOLOGICAL WATER QUALITY IN RELATION TO PUBLIC HEALTH,
Department of Health, Pretoria (South Africa).
For primary bibliographic entry see Field 3C.
W80-00482

EFFECTIVENESS OF SAND FILTERS FOR BACTERIOPHAGE ESCHERICHIA COLI T1 REMOVAL USING CALCIUM AS AN AID,
Auburn Univ., AL. Dept. of Civil Engineering.
S. R. Jenkins, and J. L. Barton.
In: Chemistry of Wastewater Technology, p 99-110, 1978. Ann Arbor Science Publishers, Inc. Ann Arbor, Michigan. OWRT A-064-ALA(2), 14-34-0001-9001.

Descriptors: *Virus, Water treatment, Calcium, Sand filters, *Bacteriophages, Wastewater treatment, Escherichia coli.

The investigation dealt with enhancing the effectiveness of sand filtration processes for virus removal. Since filtration processes are common to both wastewater and water treatment, a better understanding of virus removal mechanisms and the effect of filter aids on this removal is of interest in both areas. In particular, this research investigates the effectiveness of model and sand filters for removal of Escherichia coli T1 phage when calcium is used as a chemical conditioner. Although the flowrate passing through the filters was more representative of those found in tertiary treatment of wastewater.
W80-00493

INDIVIDUAL NON-URBAN WASTEWATER TREATMENT AND MANAGEMENT ALTERNATIVES: TASK B: SUMMARY OF ALTERNATIVE ON-SITE WASTEWATER TREATMENT AND DISPOSAL METHODS, REGION J, N.C.
Triangle J Council of Governments, Research Tri-

angle Park, NC.
November 1978. 99 p. PO-04099-01-08.

Descriptors: *Septic tanks, *Wastewater treatment, *Wastewater disposal, *Water quality management(Applied), *Triangle J Region(NC), Waste water, Waste disposal, Water quality, Disposal, Sewage disposal, Discharge, *Waste treatment.

The overall purpose of Task B is to provide easy access to information on a wide variety of alternatives for on-site treatment and disposal of wastewater for the Triangle J, N.C. region. The options range from simple modifications of the conventional septic tank/soil absorption system to more complex and innovative methods of on-site treatment. The authors see the use of septic tank systems as substantially increasing in the Region and therefore stress the options for proper collection, handling, treatment and disposal of septage. The effectiveness of septic tank systems is dependent on the proper flow of wastewater through the system and the avoidance of hydraulic overload. Therefore, water conservation practices and methods are important and those suggested include greywater reuse, dual flush toilets and flow constricting devices on faucets and shower heads. In those areas which cannot support septic systems due to restrictive soils or population density the authors emphasize cluster systems where there is sewage collection from groups of homes or small communities into a larger septic tank or directly into a central waste treatment facility. Brief comments on costs are included for most individual options. (Iervolino-NC)
W80-00534

ENVIRONMENTAL POLLUTION CONTROL ALTERNATIVES: MUNICIPAL WASTEWATER,
Culp/Wesner/Culp, El Dorado Hills, CA.
G. Culp.
Prepared for U.S. Environmental Protection Agency, Technology Transfer, Report No. EPA-625/5-76-012, May 1976. 79 p.

Descriptors: *Waste water treatment, *Municipal wastes, *Sewage treatment, *Effluents, *Oxidation, *Activated sludge, *Sludge, *Sludge treatment, Environmental sanitation, Water pollution, Advanced waste treatment, Primary treatment, Secondary treatment, Trickling filters, Waste disposal, Sludge disposal, Aeration, Organic wastes, Biochemical oxygen demand, Chemical oxygen demand.

This study delineates the potential treatment methods for sludge waste from municipal wastewater. Most of the impurities removed from wastewater are in the form of solids, leaving a residue called 'sludge'. Advanced treatment removes between 95% and 99% of the final impurities, but results in the remaining sludge wastewater. Current wastewater treatment methods--primary, secondary and advanced--are discussed, with advantages and disadvantages, costs, energy and space requirements presented. Five steps for handling and disposing of sludge resulting from treatment are presented: (1) conditioning the sludge with chemicals or heat so that water may be readily separated; (2) thickening--removal of more water by gravity or flotation; (3) dewatering--further separation of water by subjecting the sludge to vacuum pressure; (4) stabilization of the organic solids so that they may be safely handled; and (5) the reduction of solids to a stable form by wet oxidation processes or incineration. Alternatives for wastewater treatment and handling of sludge must consider factors such as current effluent and space requirements, the nature of the raw wastes, air pollution effects, safety considerations, costs, resource consumption, economic and environmental effects of sludge production, and reliability of the process selected. (Arnold-NC)
W80-00544

ANALYSIS OF OPERATIONS AND MAINTENANCE COSTS FOR MUNICIPAL WASTEWATER TREATMENT SYSTEMS,
Dames and Moore Water Pollution Control Engineering Services, Denver, CO.
For primary bibliographic entry see Field 6B.
W80-00549

5E. Ultimate Disposal Of Wastes

MAIN TRENDS IN TREATMENT OF MUNICIPAL AND INDUSTRIAL SEWAGE IN THE USSR,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
For primary bibliographic entry see Field 5D.
W80-00464

POTENTIAL GROUND WATER POLLUTION FROM SEWAGE SLUDGE APPLICATION ON AGRICULTURAL LAND,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5G.
W80-00489

INTEGRATION OF RESIDUAL WASTE MANAGEMENT WITH WATER QUALITY MANAGEMENT,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
For primary bibliographic entry see Field 6E.
W80-00526

LONG-TERM EFFECTS OF LAND APPLICATION OF DOMESTIC WASTEWATER: VINELAND, NEW JERSEY, RAPID INFILTRATION SITE,
Benham-Blair and Affiliates, Inc., Oklahoma City, OK.
E. L. Koerner, and D. A. Haws.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 501, Price codes: A09 in paper copy, A01 in microfiche. Environmental Protection Agency, Report EPA-600/2-79-072, March 1979. 167 p, 11 fig, 27 tab. 68-03-2363.

Descriptors: *Domestic wastewater, *Rapid infiltration systems, *Effluents, *Primary effluent, *Groundwater pollution, *Land treatment, *Vineland(NJ), Wastewater, Infiltration, Groundwater, Evaluation, Analysis, Wastewater disposal, Groundwater recharge, Soil properties, Trace elements, Water chemistry, Wastewater treatment, Municipal wastes.

This report presents the findings of a study on the long-term effects of applying treated domestic wastewater to an infiltration site at Vineland, NJ. Using a high rate, rapid infiltration method, primary treated domestic wastewater has been applied to three separate infiltration basins for approximately 50, 29 and 3 years, respectively. To evaluate the effects water and soil samples taken from the test site were compared with similar samples taken from a control site that was upstream and did not receive any wastewater. Sample analyses included metals, nutrients, organics, bacteria and viruses. In the effluent applied to Basin I mean concentrations of 18 of the 48 parameters analyzed statistically were found to be significantly greater than in the control groundwater. Sixteen of the eighteen parameters were found to be significantly greater in the test site groundwater below Basin I than in control groundwater. In the effluent applied to Basins II and III differences in 20 mean concentrations out of the 48 analyzed parameters were found to be greater than in the control groundwater. Mean concentrations for 17 and 13 parameters for test groundwater below Basins II and III, respectively, were found to be significantly greater than concentrations in the control groundwater. (Iervolino-NC)
W80-00529

ENVIRONMENTAL POLLUTION CONTROL ALTERNATIVES: MUNICIPAL WASTEWATER,
Culp/Wesner/Culp, El Dorado Hills, CA.
For primary bibliographic entry see Field 5D.
W80-00544

TRANSPORT OF VIRUSES THROUGH ORGANIC SOILS AND SEDIMENTS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Scineces.
P. R. Scheuerman, G. Bitton, A. R. Overman, and G. E. Gifford.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 105, No. EE4, Proceedings Paper 14756, p 629-640, August 1979. 8 fig, 2 tab, 14 ref, 1 append. NSF ENV73-07823 A02.

Descriptors: *Viruses, *Sewage effluents, *Waste water disposal, Soils, Organic soils, Humus, Organic matter, Soil text ure, Humic acids, Hydrogen ion concentration, Leaching, Sediments, Laboratory tests, Land application, Virus transport.

A black organic sediment (15.5% organic carbon) retained only 60% and 75% of virus suspended in secondary effluent and groundwater, respectively. When some of the water-soluble 'humic materials' were leached from the sediment, the sorptive capacity was increased. Further investigation of the interfering capacity of these humic substances revealed that they interfere significantly with the adsorption capacity of poliovirus to a sandy soil. The addition of CaCl2 to humic solutions was shown to restore the sorptive capacity of the soil. Molecular weight fractionation by ultrafiltration showed that the decrease in virus adsorption is due to fractions with a molecular weight below 50,000. An organic muck soil (45.4% organic carbon) was found to retain 92% and 82% of the applied virus suspended in groundwater and sewage effluent, respectively. It was concluded that organic soils are not particularly suitable for the application of sewage effluent. (Sims-ISWS)
W80-00584

RECHARGE TO LOW-LEVEL RADIOACTIVE-WASTE BURIAL TRENCHES 11 THROUGH 14, WEST VALLEY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
D. E. Prudic.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver, CO. 80225. Microfiche $3.50, paper copy $1.00. Geological Survey open-file report 79-990, 1979. 5 p, 1 fig, 2 ref.

Descriptors: *Radioactive waste disposal, *Underground waste disposal, *Infiltration, Groundwater recharge, Clays, Cements, Cracks, Water level fluctuations, *West Valley(NY), Burial trenches, Trench cover.

After the dry summer of 1978, water levels began to rise in four of seven newer low-level radioactive-waste burial trenches at the Western New York Nuclear Service Center. The water-level rise in these trenches does not appear to be related to ground-water inflow, but rather to increased infiltration of precipitation through the clay-rich till cover over the trenches. The increase in infiltration is attributed to inflow through cracks caused by dessication and (or) settling of the buried refuse. (Woodard-USGS)
W80-00775

5F. Water Treatment and Quality Alteration

DRINKING WATER SUPPLY - A FIELD FOR UNICEF ASSISTANCE.
For primary bibliographic entry see Field 5D.
W80-00420

REPORT ON COMMUNITY WATER SUPPLIES,
World Health Organization, Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference;

Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, Part 3, p 971-992.

Descriptors: *Water supply development, *Developing countries, *Water resources development, *Sewage disposal, *Sanitation, *Planning, *Potable water, Domestic water, HABITAT, World Health Organization, United Nations, International cooperation, Water policy, Manpower, Governments, Priorities, Financing, Institutional constraints, Rural arreas, Public relations, Social participation.

An action strategy for developing community water supply and waste disposal programs in developing countries was submitted to the 1977 United Nations Water Conference by the World Health Organization. The report was prompted by conclusions of HABITAT, the United Nations Conference on Human Settlements held in 1976, which stated that: (1) nearly two-thirds of the populations of developing countries lack a safe and ample water supply, and even more do not have hygienic waste disposal facilities; and (2) these needs should be given top priority in all nations, and qualitative and quantitative goals should be set. These targets require drastic measures and firm commitments. Global action should include: (1) promoting increased awareness of the problem; (2) setting a target date of 1990, with priority given to the less-privileged; and (3) allocation of a larger proportion of total resources for economic and social development to water supply and sanitation. Each country should: (1) develop national plans and programs for community water supply and waste disposal geared to the 1990 target date, (2) also set intermediate goals, (3) initiate engineering and feasibility studies, (4) assess manpower needs and establish training programs, (5) conduct public opinion campaigns, (6) establish appropriate institutions, and (7) develop a national financing system. The international community should: (1) increase financial contributions, (2) cooperate in planning, and (3) intensify monitoring and reporting efforts. (Lynch-Wisconsin)
W80-00427

ON WATER REUSE PROMOTION MEASURES,
Ministry of International Trade and Industry, Tokyo (Japan).
For primary bibliographic entry see Field 6F.
W80-00477

EFFECTIVENESS OF SAND FILTERS FOR BACTERIOPHAGE ESCHERICHIA COLI T1 REMOVAL USING CALCIUM AS AN AID,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W80-00493

IMPLEMENTATION STRATEGIES FOR PUBLIC LAW 92-500, SECTION 208,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
For primary bibliographic entry see Field 6E.
W80-00524

INTEGRATION OF RESIDUAL WASTE MANAGEMENT WITH WATER QUALITY MANAGEMENT,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
For primary bibliographic entry see Field 6E.
W80-00526

LONG-TERM EFFECTS OF LAND APPLICATION OF DOMESTIC WASTEWATER: VINELAND, NEW JERSEY, RAPID INFILTRATION SITE,
Benham-Blair and Affiliates, Inc., Oklahoma City, OK.
For primary bibliographic entry see Field 5E.
W80-00529

ENVIRONMENTAL POLLUTION CONTROL ALTERNATIVES: MUNICIPAL WASTEWATER,
Culp/Wesner/Culp, El Dorado Hills, CA.
For primary bibliographic entry see Field 5D.
W80-00544

WASTEWATER AS A SOURCE OF NUTRIENTS AND WATER FOR HYDROPONIC CROP PRODUCTION IN ARID REGIONS,
California Univ., Los Angeles; and American Univ., Beirut (Lebanon), and Alexandria Univ. (Egypt).
A. Wallace, S. M. Soufi, and A. M. El Gazzar.
Advances in Desert and Arid Land Technology and Development, v. 1, Adli Bishay and Wm. G. McGinnies, eds. Harwood Academic Publishers 1979, p 263-270, 1 fig, 9 ref.

Descriptors: *Water reuse, *Recycling, *Municipal wastes, *Hydroponics, Reclaimed water, Cultures, Crop production, Urban hydrology, Greenhouses, Cycling nutrients, Nutrient requirements, Aquatic productivity.

An online hydroponic culture system is described and discussed here as a means of recycling urban wastewaters in underdeveloped arid regions. An initial pilot plant plastic greenhouse 9.2 sq. m constructed at the Tapia Plant of the Las Virgenes Municipal Water District in Los Angeles County, California, has shown that reclaimed water from a sewage plant at Calabasas, California was, with the exception of iron, a satisfactory source of nutrients for growing crop plants in hydroponic culture under pilot plant commercial conditions. A generalized scheme for the use of hydroponic plant growth procedures in wastewater treatment processes is illustrated in which crop plants deplete or strip nutrients from the water making it more suitable for the next stage of water renovation, which could even be additional hydroponic culture. The wastewater can be used for irrigation at various stages or it can have other domestic or urban uses. It is concluded that while the pilot project described here demonstrated that commercial horticultural crops could be grown using municipal wastewater as the source of nutrients and water, the limits of many important cultural parameters have not yet been determined. (Tickes-Arizona)
W80-00642

5G. Water Quality Control

SWEDISH POLICY FOR WATER QUALITY PROTECTION,
National Swedish Environment Protection Board, Stockholm.
For primary bibliographic entry see Field 6E.
W80-00454

TOXIC SUBSTANCES IN WATER--THE U.S. EXPERIENCE.
Environmental Protection Agency, Washington, DC.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 2017-2034.

Descriptors: *United States, *Water pollution control, *Poisons, *Water pollution sources, *Chemicals, *Industrial wastes, Bioaccumulation, Environmental protection agency, Carcinogens, Public health, Human diseases, Regulation, Water quality standards, Effluent limitations, Water pollution effects, Radioisotopes, Radioactive wastes, Metals, Organic compounds, Legislation, Federal Toxic Substances Control Act, Federal Water Pollution Control Act, Amendments of 1972, Policy, Pesticides, Effluents, Methodology, Governments.

Measures adopted by the United States for controlling industrial discharge of toxic substances are described. Of special concern are metals, metallic compounds, synthetic organic compounds, and ionizing radiation. Chemicals which particularly threaten man are lead, cadmium, cadmium sulfate, kepone, carbon tetrachioride, chlorinated phenols, ethylene glycol, asbestos, beryllium, dioxin, and mercury. Toxic substances are major carcinogens, and highest cancer rates occur in areas of most concentrated industrial chemical use and activity. Introduction of toxic substances is controlled in the U.S. mainly by: (1) regulation of products and their uses, and (2) regulation of industrial effluents. The former is accomplished by reducing inputs of the toxic material or finding a substitute, the latter by altering the production process or through treatment. Effluent guidelines, water quality standards, and pretreatment and toxic substances restriction have been combined by the Environmental Protection Agency into an integrated, flexible, and technology-related strategy for control of toxic substances. Special restrictions were placed on aldrin/dieldrin, DDT (DDD, DDE), endrin, toxaphene, benzidine, and PCBs. Appendices to this report present a summary of the Toxic Substances Control Act of 1976, a list of specified pollutants, industrial point source categories, decay characteristics of transuranic nuclides, and evaluation and testing procedures. (Lynch-Wisconsin)
W80-00456

DETERIORATION OF WATER QUALITY DUE TO LONG RANGE TRANSPORT OF AIR POLLUTION,
A. Tollan, and B. Hagerhall.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 2059-2070.

Descriptors: *Acid precipitation, *Air pollution, *International cooperation, *Water pollution sources, *Airborne transport, *Scandinavia, Sweden, Norway, United States, Canada, Europe, Industrial wastes, Path of pollutants, Hydrogen ion concentration, Acidic water, Precipitation(Atmospheric), Sulfur, Nitrogen, Lakes, Rivers, Fish, Forests, Environmental effects, Dry deposition, Fossil fuels.

Increased acid precipitation is the main cause of extensive losses of salmonid fish stocks and other fish populations in southern Scandinavia, northeastern United States, and southeastern Canada. In addition, airborne transport of sulfur compounds are a threat to forest ecosystems and productivity, and to human health. Extensive surveys conducted in Sweden and Norway have documented adverse effects of the transport of pollutants through the atmosphere, and research has indicated that the major source of acid precipitation in Scandinavia is the combustion of fossil fuels in the heavily industrialized parts of Europe. Highly acid precipitation in a central area of Europe as early as the 1960s had a pH of 3-4, and the area is growing steadily larger. All governments should reduce emissions of pollutants to the air. The Governments of Norway and Sweden have prohibited use of heavy oil containing over 1% sulfur. World efforts to monitor and evaluate long-range transmissions of air pollutants across national frontiers must be intensified, and data collection should be integrated in the United Nation's Global Environmental Monitoring System. The present policy in some countries of dispersing harmful pollutants by means of tall stacks is no longer acceptable. International cooperation in reducing air pollutant emissions is needed. (Lynch-Wisconsin)
W80-00458

METHODS OF GROUND-WATER PROTECTION FROM POLLUTION,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 4B.
W80-00463

POLLUTION CONTROL IN THE MINING INDUSTRY IN SOUTH AFRICA,
R. T. Rudd.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, part 4, p 2583-2600.

Descriptors: *South Africa, *Water pollution control, *Mine wastes, *Water pollution sources, *Mining, Gold mines, Coal mines, Water shortage,

Arid lands, Bafokeng Mine(South Africa), Coal mine wastes, Slime, Mine water, Mine drainage, Waste dumps, Dams, Legislation, Regulation, Industrial wastes.

Mine-related water pollution in South Africa is discussed, including causes, control measures, specific problems of gold and coal mines and mines containing toxic material, and the 1974 Bafokeng disaster. Regulations of the 1956 water act and regional standards for industrial effluents are given. Mining may cause water pollution because of: (1) disturbance of soluble material which pollutes water pumped from the mine, (2) leaching of materials such as chlorides from nonmined geological strata, (3) chemicals used in mining (e.g., nitrates formed by blasting), (4) bacteriological pollution from human contact or excreta, (5) solids from dumps, (6) chemical reaction of normally innocuous material upon exposure to the air, and (7) erosion of rocks causing suspended sediment loading of waters. Pollution control is based on: (1) water use limitation, (2) containment or isolation of specific polluting elements such as slimes dams or reduction works, (3) effluent quality control and safe disposal of substrandard effluent, and (4) limiting the scope of unavoidable pollution and minimizing effects. All mines are required to: (1) economize water use, (2) prevent entry of storm water, (3) dispose of underground water according to regulations, (4) build polluting facilities at sites away from water sources, and (5) purify and safely dipose of or reuse effluents. At the Bafokeng platinum mine a slimes dam breach killed several people, caused a fishkill, and spread slimes over a large area. (Lynch-Wisconsin)
W80-00484

POTENTIAL GROUND WATER POLLUTION FROM SEWAGE SLUDGE APPLICATION ON AGRICULTURAL LAND,
Connecticut Univ., Storrs. Inst. of Water Resources.
R. W. Wengel, and G. F. Griffin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-10297, Price codes: A02 in paper copy, A01 in microfiche. Research Project Technical Completion Report, 1979. 17 p, 10 tab. OWRT A-074-CONN(1). 14-31-0001-6007.

Descriptors: *Sewage sludge, *Land application, *Groundwater pollution, Nitrates, Heavy metals, Leaching, Soil nitrates, Corn silage, Zinc, Copper, Cadmium, Lead, Nickel.

Corn for silage was grown for three years on land treated with either annual applications or a single application of limed, dewatered sewage sludge at six rates of application; 0, 13, 33, 66, 99 and 132 metric tons per hectare, dry weight. Yields of silage, heavy metal uptake, soil heavy metals, soil nitrates and soil pH were measured. Soil pH increased under all sludge applications in proportion to rate and total amount of sludge applied. At the highest rate of application, soil pH of the surface layer was 7.7 and 7.2 for annual and single applications, respectively. High soil pH reduced extractability of soil metals and also crop uptake of zinc. Soil Cd, Cu, Ni, Pb and Zn increased with sludge application rate only in the plow layer. No leaching of these metals occurred. Soil nitrates increased with sludge application rate. Leaching and accumulation of nitrates at depths of 244 cm were shown at high application rates. Soil nitrates and soil pH were two factors that would limit sludge application rates in this study. Residual nutrients from sludge suggest best management to be decreasing rates of sludge application over the three year period of application. (de Lara-Conn)
W80-00489

IMPACTS OF A LARGE RECREATIONAL DEVELOPMENT ON WATER QUALITY IN A SEMI-PRIMITIVE ENVIRONMENT,
Montana State Univ., Bozeman. Inst. of Applied Research.
For primary bibliographic entry see Field 5C.
W80-00498

URBAN STORMWATER POLLUTION: AN INVESTIGATION OF THE PROBLEM AND ITS CONTROL,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
For primary bibliographic entry see Field 5B.
W80-00525

INDIVIDUAL NON-URBAN WASTEWATER TREATMENT AND MANAGEMENT ALTERNATIVES: TASK B: SUMMARY OF ALTERNATIVE ON-SITE WASTEWATER TREATMENT AND DISPOSAL METHODS, REGION J, N.C.
Triangle J Council of Governments, Research Triangle Park, NC.
For primary bibliographic entry see Field 5D.
W80-00534

CHEMICAL POLLUTANTS OF THE NEW YORK BIGHT; PRIORITIES FOR RESEARCH,
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
For primary bibliographic entry see Field 5C.
W80-00697

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

RESOURCES AND NEEDS: ASSESSMENT OF THE WORLD WATER SITUATION,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata; Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 1, p 1-45.

Descriptors: *Water management(Applied), *Water supply, *Water resources development, *Basic data collections, *Water demand, Adoption of practices, Forecasting, Projections, Research priorities, Water policy, United Nations Water Conference, Water distribution(Applied), Water shortage, Management.

The worldwide supply of water is a fixed quantity and 97.3% of it is ocean water not readily useable for domestic, industrial or irrigation purposes without desalination. Most current projections on a global scale show accelerating future demands on this finite stock, and gross water demand has already exceeded water supplies in some places. But instead of assuming that current demand-supply patterns must necessarily persist, it is more useful to examine alternative and approved water conservation techniques through which policy makers might rationalize water consumption habits so as not to outstrip supplies. But to accomplish this, ways must be found to implement effective and socially acceptable management procedures for water demand before the need to use them is dictated by the timing of worldwide water shortages. Other global water management problems: (1) For much of the world, basic data is inadequate for water supplies and their rational use. (2) Because of large present margins of error in the data base, water management decisions are beset by uncertainty and inaccurate forecasting. (3) The gap between scientific knowledge and its application is widening in most parts of the world. The most urgent water management need is not that of devising new administrative methods but of utilizing technology and institutional schemes which are available now. (Harris-Wisconsin)
W80-00401

THE PROMISE OF TECHNOLOGY: POTENTIAL AND LIMITATIONS, PART ONE,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 1, p 47-69.

Descriptors: *Water management(Applied), *Technology, *Water supply, *Water demand, *Industries, United Nations Water Conference, Methodology, Water users, Water resources development, Institutional constraints, Economics, Costs, Political aspects.

Considerations of technological options for water resources management (WRM) must also focus on technologies of numerous activities with linkages to and impacts upon the water supply. Basic considerations include implementation incentives and institutional arrangements, societal objectives and constraints, current economic dynamics, water demand-supply gross variations, local spatial infrastructure, projected operations, and maintenance problems, associated inputs such as energy and land, productivity and other process application effects, incremental costs, and returns per unit of water supply, and relationship of technological options to each of several water resource system components. WRM technologies fall in three categories: (1) physical-engineering technologies; (2) computational-analytical technologies; and (3) production technologies external to the WRM system but affecting it. The range of options includes exploration and assessment of water resources, development of new sources, direct improvement of water body assimilative capacity, water transport, on-site water utilization, WRM systems planning and operation, and non-conventional options. Choice criteria are: complexity, dependability, flexibility, timing, labor availability, cost, related non-human inputs, cost-effectiveness, accessibility to users, availability of associated inputs, management organization, use of local materials, relation to other projects, side effects, accuracy of estimates, and political considerations. (Harris-Wisconsin)
W80-00402

THE PROMISE OF TECHNOLOGY: POTENTIAL AND LIMITATIONS. PART TWO,
World Meteorological Organization, Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 1, p 71-112.

Descriptors: *Water management(Applied), *Technology, *Water supply, *Irrigation, *Water resources development, *Waste water treatment, United Nations Water Conference, Irrigation efficiency, Water supply, Waste water disposal, Remote sensing, Satellites(Artificial), Data transmission, Nuclear moisture meters, Groundwater, Groundwater recharge, Erosion control, Sediment control, Forecasting, Model studies, Computer models, Flood control, Weather modification, Artificial precipitation, Evaporation control, Desalination.

Three general areas in which technological backup can be applied to worldwide water resources management problems are discussed: (1) technologies for assessment and enhancement of water resources; (2) improving efficiency of water use in agriculture; and (3) technology in community water supply and waste water disposal. Developing countries may benefit to a varying degree from any or all of 10 kinds of modern technology for water resources management: remote sensing and satellites for data transmission; nuclear waste assessment techniques; groundwater assessment and enhancement; erosion and sedimentation control; improved forecasting methods; modelling and computers; flood management; weather modification, especially induced precipitation; evaporation suppression; and desalination. Agricultural water use can be improved through efficient forest and range management; rain water harvesting; management of water bodies; land use planning; control of land degradation caused by water erosion, sedimentation, flooding, waterlogging and salinity; management in irrigation; control and metering devices for water distribution; and conjunctive use of differing water sources. Important issues affecting water supply and wastewater technology include: source development and protection; water purification and quality control; transportation, storage and distribution of water; collection of waste water; and waste water treatment. (Harris-Wisconsin)
W80-00403

POLICY OPTIONS,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 1, p 113-152.

Descriptors: *Water management(Applied), *Water resources development, *Water policy, Water allocation(Policy), United Nations Water Conferences, Non-structural alternatives, Water law, Water rights, Regulation, Planning, Land use, Water demand, Forecasting, River basin development, Legislation, Pollution taxes(Charges), Water rates, Water distribution(Applied), Water supplies, Municipal water, Domestic water, Water pollution control, Industrial wastes.

The rationale, objectives, main overall options and sectoral options for developing a worldwide policy for water resources management are discussed. While no single policy option is best suited for all times and places, a judicious blend of structural and non-structural measures for policy development will be based on the following considerations: (1) Compilation of complete inventories of existing water resources and water rights. (2) Coordination of planning for both the land and water resources of any given region. (3) Determination of water demand by successive approximations of various sectors of the economy on a basin or regional basis. (4) Physical forecasting and warning services to be applied especially in areas where droughts and floods regularly recur. (5) Consolidation of regional water agencies and their coordination by national planning bodies. (6) Enactment of comprehensive water legislation to replace or complement sectoral legislation. (7) Adoption of user fees and charges for water supply and effluent systems. (8) Water law for agriculture that shall insure coordinated distribution of water supply by an agency at geographically and administratively appropriate levels of governmental authority. (9) Legal and regulatory provision to assure adequate water supplies for domestic and municipal use and to regulate consumption and disposal of effluent at reasonable cost. (10) Adequate pollution control as a supplement to regularized water distribution for the industrial sector. (Harris-Wisconsin)
W80-00404

PRESENT AND FUTURE ACTIVITIES OF THE UNITED NATIONS SYSTEM IN WATER RESOURCES DEVELOPMENT.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 1, p 153-271.

Descriptors: *United Nations Water Conference, *Water management(Applied), *Water resources development, *International cooperation, *Institutions, Food and Agricultural Organization, International Development Organization, World Health Organization, Childrens Education Fund(UNICEF), UN Environmental Program, UN Development Program, International Atomic Energy Agency, World Bank.

Program proposals are given for improving the capacity of the UN to serve water resources management needs of developing countries more effectively and on a layer scale than in the past. Roles and general objectives of UN agencies involved in water resources development are described. Agencies included are: Food and Agricultural Organization, International Development Organization, World Health Organization, Children's Educational Fund (UNICEF), UN Environmental Program, UN Development Program, International Atomic Energy Agency, and World Bank. Present water resource-related activities of these organizations are analyzed; indication is given of how these activities might develop in the future, particularly in light of the worldwide goals being proposed at the United Nations Water Conference of 1977. General UN institutional problems for water resources management are discussed, including program coverage impact for individual agencies and problems of effective evaluation of ongoing activities. Constraints and inter-program institutional reinforcement are discussed. Two recommendations are made to the 1977 UN Water Conference: (1) A proposed Interagency Water Resources Board would have membership from among all international agencies with water-related programs. The board would coordinate all such programs, provide technical assistance at the inter-secretariate level, provide direct technical help to member states, and perform other advisory services. (2) Because of regional variances among water resources and water-related problems, the mandate of various UN regional commissions should be strengthened in the area of water resources management. (Harris-Wisconsin)
W80-00405

REPORT OF THE ESCAP REGIONAL PREPARATORY MEETING FOR THE UNITED NATIONS WATER CONFERENCE.
Economic and Social Commission for Asia and the Pacific (UN), Bangkok (Thailand).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 371-418.

Descriptors: *Economic and Social Commission for Asia and the Pacific, *United Nations Water Conference, *Regional planning, *Asia, *Pacific Ocean, *Water supply, International commissions, United Nations, Water demand, Planning, Priorities, Water resources development, Policy, Governments, Water law, Administration, Institutions, Water pollution control, International waters, Water resources.

The report to the United Nations Water Conference at Mar del Plata, Argentina in March 1977 by the U.N. Economic and Social Commission for Asia and the Pacific (ESCAP) is presented, together with the deliberation of the regional commission at a preparatory meeting at Bangkok, Thailand July-August 1976. ESCAP met to assess water supply and demand problems of member countries, to identify important issues and constraints affecting national water programs, and to draft the report to the Water Conference. Summaries of country reports are included. The report submitted to the conference includes two sections: (1) background information based on chiefly the country reports, and (2) matters requiring attention for achieving water supply and management goals, with recommendations for action. The first section deals with total water resources, supply and demand and water quality. The second section discusses: (1) institutions and policies, (2) water law and administration, (3) the relationship between land management and water resources, (4) domestic vs. imported expertise, (5) basic data gathering, (6) water resources assessment (stream discharge, available water, water quality), (7) water use (including changes in water quality), and (8) water management (water regulation, distribution, use, and quality), and (9) special issues (rural water supply, mitigation of flood and drought loss, desalination, weather modification, evaporation suppression, aquifer recharge, remote sensing, international rivers, education, and research management). (Lynch-Wisconsin)
W80-00406

REPORT OF THE REGIONAL PREPARATORY MEETING OF THE COUNTRIES OF LATIN AMERICA AND THE CARIBBEAN FOR THE UNITED NATIONS WATER CONFERENCE,
Economic Commission for Latin America (UN), Mexico City.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 419-466.

Descriptors: *United Nations Water Conference, *Latin America, *Regional planning, *Economic Commission for Latin America, *Water resources development, United Nations, Water resources, South America, Central America, Planning, Panama Canal Zone, International commissions, Governments, Water law, International law, Sovereignty, Water utilization.

The United Nations Economic Commission for Latin America met in Lima, Peru, August-September 1976 preparatory to the United Nations Water Conference at Mar del Plata, Argentina, March, 1977. Summaries are given of statements by member countries on their major water resources development problems, plus statements by several intergovernmental and nongovernmental organizations (FAO, UNESCO, WHO/PASB, IRBD, WMO, UNICEF, UNEP, UNDP, OAS, IDB, and AIDA.) Based on country reports submitted prior to the meeting, a preliminary draft of the ECLA Regional Report to the Water Conference, 'The Water Resources of Latin America', was prepared and subsequently revised at the meeting. The final version is published elsewhere in this volume. Country summaries are given here for Argentina, Ecuador, Jamaica, Dominican Republic, Chile, Colombia, Bolivia, Venezuela, Paraguay, Panama, Cuba, Mexico, Peru, Honduras, Uruguay, Guyana, Antigua and Barbuda, Nicaragua, Guatemala, El Salvador, and Haiti. (Lynch-Wisconsin)
W80-00407

ECONOMIC COMMISSION FOR EUROPE. REGIONAL REPORT,
Economic Commission for Europe (UN), Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 2, p 467-518. 12 tab.

Descriptors: *Water management(Applied), *Economic Commission for Europe, *Europe, *United Nations Water Conference, *Water resources development, *Regional planning, International commissions, Water resources, United Nations, International waters, Lakes, Water supply, Water demand, Planning, Governments, Aquifers, Water sources, Irrigation, Water pollution control, Expenditures, Institutions, Administration, International agreements, Policy, Social participation.

A regional report to the United Nations Water Conference at Mar del Plata, Argentina, March 1977 by the Economic Commission for Europe (ECE) reviews water problems and water management in the 33 member nations. Conclusions: (1) though the overall quantity of water available in most ECE countries is fully sufficient until the year 2000, it is usually not adequate in the place needed or at the time of greatest demand; (2) pollution has reduced the amount of usable water; (3) water policies have been aimed at structural, efficiency, and water quality measures; (4) actual water use is far below potential use; (5) future demand is expected to increase 3.9% annually to 1980 and 2.9% thereafter; (6) investments in water resources development range 0.29-2.04% GNP; (7) water supply costs will rise; (8) comprehensive planning is underway in many countries using models and automation; (9) public participation in development is increasing; (10) resistance to structural measures (dams and reservoirs) is growing; (11) demands for environmental protection are increasing; (12) most governments consider current pollution legislation adequate; (13) there is a trend toward centralized water management; and (14) economic incentives and charges are commonly used. (Lynch-Wisconsin)
W80-00408

ECONOMIC COMMISSION FOR AFRICA, REGIONAL REPORT,
Economic Commission for Africa (UN), Addis Ababa (Ethiopia).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 519-638. 8 fig.

Descriptors: *Africa, *Economic Commission for Africa, *United Nations Water Conference, *Water resources development, *River basins, *Water supply, *Regional planning, United Nations, Water demand, Water utilization, Energy, Data collections, Water balance, Desalination, Water pollution control, International commissions, Water resources, International waters, Governments, Planning, Institutions, Training, Policy.

The regional report to the United Nations Water Conference at Mar del Plata, Argentina, March 1977 by the Economic Commission for Africa contains an introductory section, followed by a section on principle matters requiring attention in the area of water resources development in the 34 member countries. Problems include: (1) assessment of water availability (surface water, groundwater, and nonconventional sources such as desalination); (2) utilization and development of water resources; (3) present level of utilization; (4) demand projection; (5) drought; (6) planning; (7) policy issues (policy formulation, technology, water pollution, legislation, international river basin development); and (8) major constraints (capital, manpower training, institutional problems). African water resources are characterized by relative scarcity and uneven distribution. Water availability per unit area is the lowest of the continents and the coefficient of evaporation is the highest. Water pollution is principally a result of sewage and industrial effluents. Acute capital scarcity is a major impediment to effective development of available water resources, as is a critical shortage of trained personnel and training programs. Institutions responsible for water resources development need streamlining, and effective mechanisms for coordination of effort at the national level need to be provided. (Lynch-Wisconsin)
W80-00409

REPORT OF THE ECONOMIC COMMISSION FOR WESTERN ASIA REGIONAL PREPARATORY MEETING.
Economic Commission for Western Asia (UN), Beirut (Lebanon).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 639-658.

Descriptors: *Middle East, *United Nations Water Conference, *Economic Commission for Western Asia, *Water resources development, *Regional planning, International commissions, Desalination, United Nations, Water demand, Water supply, Water pollution control, Water resources, Governments, Planning, Policy, Arid lands, Groundwater recharge, Aquifers.

The regional report to the United Nations Water Conference at Mar del Plata, Argentina, March 1977 by the Economic Commission for Western Asia includes an account of the preparatory meeting of the ECWA held at Baghdad, Iraq, December 1976. At the meeting brief country reports were given, statements were made by UNEP, WHO, Council of Arab Economic Unity, and Arab Fund for Economic and Social Development, and a draft of the regional report was revised. Members of ECWA are Bahrain, Democratic Yemen, Iraq, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Yemen Arab Republic, and United Arab Emirates. The report contains: (1) physical features and meteorology, (2) an assessment of water resources and needs, (3) technology, and (4) policy options. Most of the region falls into the arid and semiarid zones, typified by the Arabian Peninsula where few areas receive over 100 mm average rainfall, and many receive none at all. There is a critical shortage of data on meteorology, hydrology, and water use in most areas. Water demand is increasing for municipal, industrial, and rural domestic use, while agricultural demand is increasing in some areas but has stabilized in others. Seawater desalination has been a major water source for 30 years. The potential for groundwater recharge is vast, and has been applied on a limited scale. Most of the countries lack a clearly defined water policy, and water pollution control, especially in coastal and marine areas, needs serious attention. There is an acute need for trained manpower. (Lynch-Wisconsin)
W80-00410

SOCIO-ECONOMIC ASPECTS OF URBAN WATER RESOURCES PLANNING AND MANAGEMENT,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 685-698.

Descriptors: *Planning, *Urban hydrology, *Urban sociology, *Water resources development, *Water management(Applied), *Water supply, *Waste disposal, Municipal wastes, Social aspects, Decision making, Developing countries, Costs, Urbanization, Water demand, Social needs, Multiple-purpose projects, Water reuse, Municipal water, Economics, Hydrology, Solid wastes, Sewage disposal, Groundwater.

Conclusions and recommendations of a workshop on Socio-Economic Aspects of Urban Hydrology held at Lund, Sweden in November 1976 are presented, as well as material from the report of the 1973 UNESCO workshop on Hydrological Effects of Urbanization held at Warsaw, Poland. The paper focuses on: (1) the role of water in urban society, (2) multipurpose planning, and (3) urban planning and development as a function of water availability. The most important water-related urban problem is the interrelationship of augmented water demand and waste disposal. In addition, solid waste disposal in dumps and sanitary landfills often severely pollutes groundwater and, through leaching, surface water. Present knowledge of the relationship between urban hydrology and socio-economic factors is inadequate. Urban water management and planning, and decision-making processes, are social in nature and result from complex interactions of: (1) needs, (2) type of development, (3) organizational capability of institutions, (4) urban social structure and community types, and (5) values, attitudes, and goals of planners, workers, administrators, and residents. Resolving urban water problems requires a holistic approach to analysis of the water system's component subsystems, such as water demand, water supply, sewage disposal, etc. A feedback monitoring system is needed to control the three basic functions of time, space, and quality. Planning should consider welfare, social well-being, and quality of life. Project evaluation and liaison are discussed. (Lynch-Wisconsin)
W80-00413

THE WATER RESOURCES OF LATIN AMERICA REGIONAL REPORT,
Economic Commission for Latin America (UN), New York.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, Part 2, p 721-790.

Descriptors: *Latin America, *Water resources development, *United Nations Water Conference, *Regional planning, *Water supply, *Water demand, River basins, South America, Central America, United Nations, Economic Commission for Latin America, Data collections, Water resources, Electric power generation, Hydroelectric power, Planning, Policy, Technology, Water pollution control.

The regional report of the Economic Commission for Latin America (ECLA) to the United Nations Water Conference at Mar del Plata, Argentina, March 1977 describes the area's water resources. Contents: (1) water supply and uses, (2) technological potential and limitations, and (3) policy options. Though Latin America has the most abundant water resources in the world, there are also arid areas and rapid demographic and economic growth has greatly increased water requirements. Waterborne diseases remain a problem, and water pollution is growing increasingly serious. During 1961-1970, 4% of gross investment was allocated to water development projects, possibly reaching 5% 1971-1980. Future investment will probably be allocated 50% to hydroelectric projects, 30% to urban water supply and sewage, and 20% to irrigation, drainage, flood control, and other purposes. Industrial water consumption (including thermal power stations) could increase 350% by the year 2000. Hydroelectric water demand is the use increasing most rapidly in the region, with power generation increasing 9% per yr. Several areas of acute water shortages are listed. Policy options are discussed under: (1) legislation and institutions, (2) planning, (3) sectoral strategies (water supply and sewerage, agriculture irrigation, flood plains), (4) industry and mining, (5) nonconsumptive water use, (6) financial questions, (7) technological development, (8) environmental and health considerations, (9) extreme situations, and (10) shared basins. (Lynch-Wisconsin)
W80-00415

WATER, WOMEN, AND DEVELOPMENT,
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 791-810.

Descriptors: *Women, *Water resources development, *Economic development, *Rural areas, *Developing countries, *Labor, *Manpower, Employment, Water supply, Public health, Solar energy, Groundwater, Water conservation, Planning, Africa, Asia, Latin America, Water carrying, Rural sociology, Crop production, Foods, Resource allocation.

The often-overlooked role of women in developing countries is intimately related to rural water technology development. Identifying the needs of rural women may clarify developmental problems and provide a valuable index for measuring progress in rural development. In many cases, water supply can become the focus of integrated rural development projects, since it supports multisectoral developments in health, food production, land use, employment, and education. Women provide 60-80% of agricultural labor in Africa and Asia, and 40% in Latin America. Water carrying, mostly done by women, requires a great amount of work time and may consume 12-25% of daily caloric needs. Water-related health dangers strongly affect women in their roles as mothers and principle caretakers of family health. Water development projects offer important employment opportunities in rural areas, and benefits to women should be carefully evaluated. Water-related technology can serve as a catalyst for incorporating women into agro-industries and other semirural industries brought into being by water availability. Special measures are needed to guarantee women equal access to training and employment. Increasing the water supply can reduce the need for water carrying and reduce health problems, thus permitting women more time for food production and other occupations. Water conservation may be the most economical means of increasing water supply, along with groundwater pumping by solar or diesel power. An appendix considers application of solar energy. (Lynch-Wisconsin)
W80-00416

BASIC NEEDS STRATEGY AND WATER RESOURCES POLICY,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 815-818.

Descriptors: *Policy, *Water resources development, *Basic needs, *Labor-intensive, *Potable water, *Resource allocation, Foods, Industries, Water resources, Developing countries, Rural areas, Domestic water, Planning, Economic development, Poverty, Irrigation, Hydroelectric power, Agriculture, Public works.

The importance of emphasizing basic human needs in economic development policy, rather than simply maximizing growth of gross domestic product, has been increasingly recognized at both national and international levels. This paper examines this strategy as applied to water resources development, specifically regarding: (1) water for drinking and domestic use, (2) water for food, (3) water and rural industrialization, and (4) water and jobs. Basic needs are limited here to material needs, which include food, clothing, shelter, employment, and public services. Regarding domestic water supply, water resources development policy should focus on rural areas where water supply systems are primitive, rather than on improving water supply in urban areas where services already exist, and programs should be geared to lower income groups. Food production policy should be

directed toward mobilizing skills and energy of rural inhabitants for water projects of agricultural water supply, deemphasizing imported capital-intensive technology. Irrigation schemes should be planned in the contest of the system of rural institutions, and of integrated rural development. Small-scale hydroelectric projects may be best-suited to developing countries with scarce foreign exchange. Employment should be generated in public works related to water supply, utilizing labor-intensive methods whenever possible in irrigation, drainage, flood control, small-scale surface water works (and parts of large scale projects), and tube wells. (Lynch-Wisconsin)
W80-00418

WORLD EMPLOYMENT PROGRAMME: APPROPRIATE CONSTRUCTION TECHNOLOGY FOR WATER CONTROL AND IRRIGATION WORKS IN DEVELOPING COUNTRIES,
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 819-846.

Descriptors: *Developing countries, *Labor intensive, *Water resources development, *Construction, *Analytical techniques, *Employment, *Manpower, Labor, Economic development, Technology, Irrigation, Administration, Institutional constraints, International cooperation, India, Philippines, Sharavathi Valley(India), Pasig River(Philippines), Sharavathi Valley(India), Pasig River(Philippines), Research priorities, Planning, Resource allocation.

With mass unemployment a very serious problem in developing countries, efficient labor-intensive construction methods should be used in water resources development projects at all appropriate stages from planning to implementation. This 'appropriate construction technology,' is analyzed in five sections: (1) scope of labor-intensive techniques, (2) criteria for the choice of appropriate technology, (3) planning and implementation issues, (4) role of international cooperation, and (5) recommendations for future research. Recent field studies by the U.N. International Labor Office of the Sharavathi Valley earthworks project, India, and the Pasig River flood control levee construction, Philippines, demonstrated labor-intensive methods to be as cheap as, or cheaper, than equipment-intensive methods, and the great potential for increasing productivity by improving existing methods or introducing new ones. Use of the proper tools and implements is essential for effective use of labor-intensive techniques; such tools can often be made locally. Factors to be considered in technology selection include: (1) equipment-intensive methods do not always produce the shortest construction time, and (2) a continuous supply of labor is not guaranteed even in a labor-surplus economy. Use of labor-intensive methods requires modification of organizational structures and administrative procedures. Multi-national firms, tied-aid arrangements, and international aid agencies are partially responsible for the trend to equipment-rather than labor-intensive technology. (Lynch-Wisconsin)
W80-00419

TECHNICAL COOPERATION AMONG DEVELOPING COUNTRIES WITH REGARD TO WATER RESOURCES DEVELOPMENT.
For primary bibliographic entry see Field 6E.
W80-00425

ASSESSMENT OF WATER RESOURCES: NETWORKS, SURVEYS, SERVICES, AND RELATED FACILITIES: PRESENT STATUS AND REQUIREMENTS BY 2000.
World Meteorological Organization, Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York 1978, Pergamon Press. Vol. 1, part 3, p 953-970.

Descriptors: *Water resources, *Assessments, *Developing countries, *Surface waters, *Groundwater, *Manpower, *Costs, Wter supply, Water resources development, Inventories, Networks, Surveys, Scientific personnel, Hydrology, Technology, Asia, Pacific Ocean, Latin America, Africa, Europe, International cooperation, Financing.

Estimates are given of monetary and manpower requirements of all developing countries (by region) for minimum assessment of their water resources by the year 2000. Water resources management and development is impossible without assessing quantity and quality of available water, but many developing countries lack minimum capability to carry out such a continuing inventory. Of the total investment of $1.3 trillion needed for data collection network development to bring surface water resources assessment to a minimum, 85% pertains to Africa and South America. By region, surface water costs are $710 million for Africa, $199 million for Asia and the Pacific (excluding China and the U.S.S.R.), $396 million for Latin America, and $5 million for Europe. The total for groundwater assessment is $7.7 trillion, $2.8 trillion in Africa, $1.4 trillion in Asia and the Pacific, $3 trillion in Latin America, and $470 million in Europe. Total world manpower requirements for surface water assessment are 1040 professionals, 4700 technicians, and 42,000 observers; for these three groups, the figures for Africa are 550, 2500, and 22,500 respectively; for Asia and the Pacific 160, 750, and 6300; and for Latin America 330, 1450, and 13,200. For groundwater assessment a total of 2465 professionals and 9600 mid-level technicians are needed, 960 and 4000 in Africa, 575 and 3000 Asia and the Pacific, and 930 and 2600 Latin America. Use of national personnel is highly recommended, but will require extensive training facilities. Increased national efforts will assist international cooperative efforts. (Lynch-Wisconsin)
W80-00426

INTERNATIONAL RIVER BASIN CO-OPERATION: THE LESSONS FROM EXPERIENCE,
British Columbia Univ. Vancouver. Westwater Research Centre.
I. K. Fox, and D. G. LeMarquand.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata; Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 3, p 1041-1062.

Descriptors: River Basin development, *International waters, *International cooperation, *Treaties, *Regional development, Rivers, River basins, Water resources development, Institutions, Political constraints, Riparian rights, Planning, Regional planning, Pilcomayo River(South America), Mono River(Africa), Niger River, Senegal River, Columbia River, Vardar-Axios River Basin, Nile River, Indus River, Zambesi River, Rhine River Basin, Water management(Applied).

A report on international river basin cooperation, is based on nine basins and one case of regional cooperation. Conclusions: (1) nations sharing a river must be willing to cooperate in its use; (2) management schemes and their consequences must be fully understood by all parties, which requires strong national water organizations; (3) river basin organizations and procedures for exchanging data and resolving technical differences, can be of invaluable assistance; and (4) a consensus on legal principles to govern resources development and use is important since in many cases an economic incentive does not exist to negotiate an efficient and equitable agreement regarding management and use of international water resources. The report is divided into: (1) factors affecting the ability to undertake cooperative action, (2) ways of foresting cooperation, and (3) institutional arrangements to facilitate joint action. The first section considers evaluative frameworks in co-riparian nations, uncertainty regarding possible effects of the agreement, boundary influences, international relations, domestic factors, and number of countries involved. Case studies cited: Pilcomayo River in the Rio de la Plata Basin (South America); Mono, Niger, and Senegal Rivers (northwest Africa); Columbia River (U.S.-Canada); Vardar-Axios River (Yugoslavia-Greece); Nile River (Egypt-Sudan); Indus River (India-Pakistan); Zambesi River (Zambia-Southern Rhodesia); and Rhine Basin (Europe). (Lynch-Wisconsin)
W80-00430

THE DESIGN AND EVALUATION OF INSTITUTIONAL ARRANGEMENTS FOR WATER PLANNING AND MANAGEMENT,
Colorado Univ., Boulder. Dept. of Economics.
For primary bibliographic entry see Field 6E.
W80-00431

WATER FOR THE THOUSAND MILLIONS,
Intermediate Technology Development Group, London (England).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, part 3, p 1105-1162.

Descriptors: *Water supply development, *Technology, *Developing countries, *Rural areas, *Appropriateness, *Analytical techniques, *Planning, *Rural sociology, Water resources development, Water supply, Water policy, Goals, Water management(Applied), Water conservation, Methodology, Social aspects, Economics, Public health, Evaluation, Africa, India, Intermediate technology, Classification, Rainwater catchment.

Experience since the 1940s with water supplies in developing countries especially for rural areas demonstrates that high-level technology is often untransferable to such areas, and most recently that attempts to use 'intermediate technology' also frequently fail because they are inappropriate to local social and economic conditions. This paper presents criteria for evaluating appropriateness of water supply technology in developing countries, classified by three categories of appropriateness: (1) technology in developing countries, classified by three categories of appropriateness: (1) technical (health and sanitary, functional, environmental); (2) social; and (3) economic. These criteria cannot be applied, however, without first defining the goals and objectives of water supply improvement at the local level. A scheme is presented for identifying such goals according to: (1) immediate objectives (functional, other); (2) stage I goals (health, energy and time savings, social, economic); (3) stage II goals (health, social/technical, economic); and (4) stage III goals (social change, improved standard of living). After defining these goals, the three criteria of appropriateness can be analyzed according to each of these classes of objectives. It is noted that technology only has a role within its environment and socio-economic context, and that the most appropriate technology often is overlooked because the range of option is restricted. The criteria presented give a village-level perspective on what constitutes an appropriate water supply. (Lynch-Wisconsin)
W80-00432

ENVIRONMENTAL ISSUES IN RIVER BASIN DEVELOPMENT,
United Nations Environment Program, Geneva (Switzerland).
For primary bibliographic entry see Field 2A.
W80-00433

LONG-TERM PLANNING OF WATER MANAGEMENT,
Economic Commission for Europe (UN), Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, Part 3, p 1173-1260.

Descriptors: *Long-term planning, *Planning, *Water management(Applied), *Forecasting, *Analytical techniques, Water demand, Classification, Methodology, Industrial water, Hydroelectric power, Regional planning, River basin development, Water policy, Cost-effectiveness, Systems analysis, Economic Commission for Europe, Water supply.

Proceedings of the Seminar on Long-Term Planning of Water Management (Economic Commis-

sion for Europe) held at Zlatni Piasatzi, Bulgaria, May 1976, are presented. Part I contains the Seminar Report, including conclusions and recommendations, plus extracts from the opening statement. Part II contains seven introductory reports on four seminar topics. Seminar topics: (1) approaches, methods, and processes of long-term planning of water management (2) water use projection methods (industrial and public water demand, agricultural and hydroelectric power); (3) economic, environmental, and technical optimization in long-term water planning; and (4) long-term planning at the regional and river basin level. Conclusions deal with: (1) principles of long-term water management planning, (2) classification of planning (forecasts, plans), (3) long-term plans, (4) forecasting of water demands, (5) optimization, and (6) application to river basin and regional development. Recommendations: (1) extend long-term water management plans to 10-15 years, completed with master plans or forecasts for 30-50 years, with periodic revisions every five years; (2) consider technical, organizational, economic, and legislative effects, with attention to cost-effectiveness, social benefits, and environmental protection; (3) link water and land-use planning; (4) utilize systems analysis techniques; (5) base national water management on the river basin; and (6) use lower quality water for cooling and irrigation. (Lynch-Wisconsin)
W80-00434

RATIONAL METHODS OF FLOOD CONTROL PLANNING IN RIVER BASIN DEVELOPMENT,
Economic Commission for Europe (UN), Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, Part 3, p 1261-1322.

Descriptors: *River basin development, *Methodology, *Flood control, *Flood plains, *Planning, *Flood damage, Evaluation, Estimating, Regional planning, Costs, Developing countries, Data storage and retrieval, Automation, Flood forecasting, Flood plain insurance, Reservoirs, Policy, Governments, Water management(Applied), Europe.

The Economic Commission for Europe's Committee on Water Problems reports on: (1) existing methods of assessing flood damage; (2) flood phenomena; (3) legislation, organizations, methods, and policies in flood control planning; and (4) methods of evaluating the economic effectiveness of flood control measures. Reports of member countries are analyzed according to responses to several issues. Conclusions: (1) Proper flood plain use is of critical importance. (2) Crop insurance may be more effective than flood prevention where losses significantly affect the regional economy. (3) Forecasts are frequently based only on hydrometric data; meteorological data improves forecasting accuracy only slightly. (4) Data collection and transmission must be automated and forecasts connected to warning systems. (5) Use of reservoirs for flood control has shown inconsistent results. (6) Flood damage is greatly dependent on degree of economic development, corresponding to a range of protective structures from none (part of Africa and South America) through partial protection (India) to control structures and flood plains. (7) Flood damage may be estimated by restoration costs, comparative value of lost property and services, or capitalization of lost income. (8) Standing flood control committees at central and local levels facilitate coordination of national flood control policies. (Lynch-Wisconsin)
W80-00435

CMEA GLOSSARY ON WATER MANAGEMENT,
Economic Commission for Europe (UN), Geneva (Switzerland). Committee on Water Problems.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 3, p 1347-1552.

Descriptors: *Glossaries, *Water management(Applied), *Engineering, *Limnology, *Water pollution control, Reservoirs, Biology, Eutrophication, Hydrology, Hydrography, Groundwater, Lakes, Rivers, Hydroelectric power, Sewage treatment, Water purification, Water resources, Fish management, Sediments, Water chemistry.

A glossary of 1257 terms related to water management was prepared by the Council for Mutual Economic Assistance and translated under auspices of the U.N. Economic Commission for Europe's Committee on Water Problems. Although items are not arranged alphabetically, many are grouped by subject. Fields represented include limnology, aquatic biology, microbiology, hydrography, water chemistry eutrophication, pollution control, engineering, hydrology, soils, glaciology, sedimentology, sewage treatment, groundwater hydrology, hydroelectric power, water purification and treatment, reservoirs, water resources economics, law, and fish management. (Lynch-Wisconsin)
W80-00437

WATER RESOURCES, PLANNING AND MANAGEMENT: A SELECT BIBLIOGRAPHY,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 3, p 1553-1663.

Descriptors: *Bibliographies, *Water resources management, *Planning, *Water supply, *Technology, *Water law, Water demand, Training, Education, Water resources development, Water resources, United Nations, Forecasting, Water pollution, Water quality, Legal aspects, Desalination, Financing, Economics, International law.

A 111-page bibliography on water resources, water resources planning, and water resources management prepared by the United Nations' Dag Hammarskjold Library contains nearly 1400 citations and primarily includes books and periodical articles published during the last 15 years. Only major United Nations documents and publications are included. Sources are organized according to: (1) water supply and demand (present situation, water resources development, projections); (2) technology (water quantity, water quality, desalination); (3) economic and financial aspects; (4) law (international, national and comparative); (5) administration, management, planning, and research); (6) training and education; (7) other bibliographies; and (8) reference works. Within sections 1-5 references are broken down by world regions. (Lynch-Wisconsin)
W80-00438

POLICY AND ORGANIZATION OF WATER RESEARCH IN THE UNITED KINGDOM.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1665-1678.

Descriptors: *United Kingdom, *Research and development, *Research priorities, *Institutions, *Administrative agencies, *Water policy, *Water management(Applied), Water resources development, Water Research Centre(United Kingdom), History, Planning, Sewage treatment, Water supply, Sludge treatment, Eutrophication, Water pollution control, Water distribution, Coasts, Estuaries, Fisheries, Recreation.

The background, current policy and institutional structure of water research in the United Kingdom are described, emphasizing practical problems of water management. Major research needs of the water industry in the United Kingdom are summarized under: (1) resources planning and management, (2) water treatment, (3) sewage treatment, (4) sludge treatment and disposal, (5) water distribution and sewerage, (6) coasts and estuaries, (7) fisheries and recreation, and (8) longer-term environmental problems. The Water Act of 1973 reorganized the water industry in England and Wales, replacing approximately 180 water projects and 29 river authorities controlling river management, and 1300 sewage authorities controlling sewage disposal, with 10 multipurpose water authorities, nine in England and one in Wales. An attempt was made to unify clean and dirty water aspect of the industry in the new, largely autonomous authorities. A policy review group recommended organizing research and development according to the customer/contractor principle. Accordingly, the former Water Research Association and the Water Pollution Research Laboratory were combined to form the new Water Research Centre, a multi-disciplinary organization employing some 250 scientists and engineers. It is financed by membership (U.K. water authorities, plus other domestic and foreign organizations), contracts, and grants. There are plans to include the Water Research Centre in a new body, the National Water Authority, which would among other duties, undertake research for the industry. (Lynch-Wisconsin)
W80-00439

ENVIRONMENTAL ASPECTS OF POLLUTION CONTROL IN HUNGARY,
Research Inst. for Water Resources Development, Budapest (Hungary).
P. Benedek, and T. Simo.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1693-1709.

Descriptors: *Hungary, *Water pollution control, *Systems analysis, *Mathematical models, *Danube River Basin, *Planning, Rivers, River basins, International cooperation, Model studies, Pollution abatement, Environmental effects, Water supply, Tisza River, Sajo River, Water balance, Regional planning, Simulation analysis.

Interrelationships of all natural and economic factors must be considered in planning and implementing environmental protection measures, which form an integral part of regional planning and systems analysis. Of Hungary's surface water supplies, about 96% originate outside the country. The Danube River forms the backbone of surface water supplies. The critical period for the water balance in Hungary is August, when surface water resources of 85% duration derive 90% from the Danube system (70% from the Danube main stem, 20% from the Drava River, and 10% from the Tisza system). Monthly profile analyses are performed on major streams. The Danube provides 50% of industrial water demand and 25% of domestic demand (primarily by means of bank filtration wells), and is increasingly used for recreation. Although the river can assimilate its effluent load over most of its length, in the Hungarian section some elements now require waste treatment, for which water quality systems analysis is being used. The comprehensive environmental system comprises: (1) a water quality data collection network, (2) water quality simulation models, and (3) appraisal of alternative measures. Two examples of water quality systems analysis in Hungary are described: (1) the Sajo Valley optimization model, and (2) the descriptive water quality component model for the Danube. The former uses the mass balance of oxidizable pollutants discharged into the river, and the latter will combine sub-models on hydraulics, hydrology, chemistry, biology, bacteriology, etc. into a final river model. (Lynch-Wisconsin)
W80-00441

POLISH RESEARCH PROGRAM FOR SYSTEM-ORIENTED REGIONAL MANAGEMENT OF WATER RESOURCES,
Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering.
J. Kindler.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1747-1754.

Descriptors: *Poland, *Water management(Applied), *Research and development, *Regional planning, *Water resources development, *Systems development, Economic development, Governments, Hydraulic engineering, Agriculture, Industrial water, Mathematical models, Model studies, Planning, Municipal water, Water supply development.

The Polish government research program for development and utilization of water resources was one of eight such programs established in 1974 to solve problems critical to economic and social development of the country. The program, to be carried out 1976-85, provides for: (1) development of a scientific and organizational base for implementation of the national water management system, and (2) realization of two regional pilot water resources systems, one in an urban/industrial area and the second in an agricultural zone. The program comprises: (1) a methodological base for system-oriented water management; (2) modernization and expansion of data collecting/processing systems on water quality and quantity; (3) technology and facilities for water quality control; (4) modern technology in hydraulic engineering; (5) an urban/industrial pilot water resources system; and (6) an agricultural pilot system. Total water demand is expected to rise from 9.0 billion cu m/yr in 1970 to 35.4 billion by 1990. The rise is associated with an increase in the volume of wastes needing treatment before disposal; excessive pollution could be the barrier limiting the volume of available water resources. Water resources systems differ from the traditional water system in encompassing not only supply but also all factors relating to water utilization by the population and the national economy. (Lynch-Wisconsin)
W80-00444

RIVER BASIN MANAGEMENT IN THE UNITED KINGDOM.
Department of the Environment, Reading (England). Central Water Planning Unit.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 1847-1876.

Descriptors: *River basin development, *Water management(Applied), *United Kingdom, *Water supply development, *Water demand, *Planning, Administrative agencies, Institutions, Water pollution control, Monitoring, Information requirements, Financing, Regional planning, Forecasting, Water conservation, Flood control, Water resources development, Drainage, Sewage treatment, Hydrology.

Various aspects of river basin management in the United Kingdom are discussed, including: (1) institutional arrangements; (2) information requirements regarding water quality, water demand, sewerage, land drainage, amenity, and recreation; (3) water resources assessment and development; and (4) financing and planning. River basins provide water management boundaries in England and Wales but not in Scotland and Northern Ireland. In England and Wales the Water Act of 1973 created 10 multipurpose regional water authorities to replace 29 river authorities, the public water supply utilities, and over 1000 sewage treatment authorities. A National Water Council advises the government on water policy, assist water authorities, provide training, and promote research. Other new agencies are the Central Water Planning Unit, Water Data Unit, and Water Research Centre. Water planning is based on: (1) assessment of water resources, and (2) estimation of water demands. Measurement of hydrological variables has so far absorbed most of the information effort, including rainfall, streamflow, groundwater level, and water quality. Future demand is projected from past water demand records. Most new reservoirs in England and Wales are destined for river regulation or, if for direct supply, are filled by pumping from a river, and many water utilities now receive at least part of their supplies from river intakes, a major departure from the conventional upland impounding reservoirs supplying piped water directly to towns. (Lynch-Wisconsin)
W80-00449

THE LONG-TERM NATIONAL PROGRAMME FOR RIVER BASIN DEVELOPMENT, BASIS OF THE WATER MANAGEMENT POLICY IN ROMANIA,
O. Blaga, A. Filotti, and C. Rusu.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 1887-1898.

Descriptors: *Romania, *Water management(Applied), *River basin development, *Long-term planning, *Water supply development, *Flood control, Soil erosion, Planning, Water policy, Socialism, Hydrography, Networks, Reservoirs, Diversion structures, Hydroelectric power, Irrigation, Water pollution control, Navigation, Water resources development, Water demand, Rivers, Danube River.

A long-term national program for river basin development in Romania enacted in 1976, covers: (1) systematization of the nation's hydrographic network during the next 30 years, (2) regulation of all watercourses, (3) construction of storage reservoirs and irrigation systems, (4) water pollution and soil erosion control, (5) hydroelectric power development, (6) improvement of inland navigation, (7) increasing fish breeding, and (8) flood control. Romania's water resources are limited to inland rivers, the Danube River, and subsurface waters. Inland rivers contribute only 37 billion cu m/yr and are frequent. River basin development will be based on reservoir construction and flow diversions. The long-term goal is 1400 reservoirs with a capacity of 34 billion cu m; for 1990 the goal is 1400 reservoirs with a capacity of 22 billion cu m. Water demand is estimated at 22.4 billion cu m for 1980, 35.0 billion for 1990, and 46.0 long-range. In 1975 39% of water went to industrial uses, 10% for drinking supplies and 5% of it to irrigation and other uses. Total hydropower potential is estimated to be 38 billion kwh/yr. Flood control has been carried out by dikes and embankments; new measures for flood control and agricultural protection include reservoirs, dredging, and soil erosion and excess moisture control. Pollution control measures include advanced wastewater treatment, industrial pollutant elimination, and water recycling. (Lynch-Wisconsin)
W80-00450

FINNISH EXPERIENCES IN WATER-RESOURCES PLANNING AND MANAGEMENT POLICY,
National Water Board of Finland, Helsinki.
A. Haverinen.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 1907-1912.

Descriptors: *Finland, *Regional planning, *Water management(Applied), *Water policy, *Water resources development, *Water supply development, *Groundwater, *Water sources, Nonpoint pollution, Agricultural runoff, Irrigation, Water balance, Water pollution control, Waste water treatment, Administrative agencies, Institutions, Water utilization, Water conservation, Surface waters, Lakes.

Regional plans in Finland for water resources management and development deal comprehensively with water use and conservation. Water resources development planning is carried out by the National Board of Waters. Finland is divided into 19 planning regions based on large drainage basins or economic areas. Despite abundant surface water resources, including 55,000 lakes, the more-scarce groundwater is preferred for community water supply because: (1) it can often be used without treatment or with only neutralization, (2) it is more economical in sparsely settled areas, (3) surface waters often have high humus content requiring chemical treatment, and (4) surface waters are more susceptible to such contaminants as radioactive pollution. Centralized wastewater treatment is superior to use of several smaller plants due to economies of scale and better control of discharges. Industrial water supply generally comes from surface waters. Reduction of industrial water consumption is encouraged by water recirculation and reuse, dry manufacturing processes, and lower supply and treatment costs with lower consumption. Heavily polluting industries are prohibited from special protection areas, and new pulp and paper mills are usually not located near inland lakes. Irrigation water supply is enhanced by dams, lake flow regulation, artificial lakes, and flow diversion. Measures enacted to reduce diffuse load from agricultural and forest areas are listed. (Lynch-Wisconsin)
W80-00451

EXPERIENCES IN JOINT ADMINISTRATION OF BORDER WATERCOURSES,
E. J. Manner, and J. U. Ratia.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1915-1933.

Descriptors: *Administration, *International cooperation, *Treaties, *International waters, *Water management(Applied), *Finland, Soviet Union, Norway, Sweden, Tornio River Basin, River basins, Rivers, Watershed management, Governments, Political constraints, River basin commissions.

The structure and provisions of individual treaties signed by Finland with Sweden, the Soviet Union, and Norway for joint administration of watercourses shared by the countries reflect the different geographical and political circumstances affecting each agreement. The 1971 Frontier-Rivers Treaty with Sweden is particularly extensive and detailed, covering all water uses and all waterways of the entire Tornio River drainage basin. The boundary between Finland and Sweden runs for almost its whole length along rivers of the basin, and the two countries have similar legal systems and support private property rights. The treaty provides for a joint administrative commission, which can be considered part of the local administration system of each country. The Finland-Soviet Union treaty of 1964 governing Frontier-Watercourses, while covering all areas of water economy, does so in much broader outline. The common boundary seldom runs along rivers, instead crossing numerous watercourses. Thus the agreement provides for a joint administrative commission with a general framework capable of incorporating all the special needs of the diverse watercourses. The commission is primarily a cooperative organ whose function is to assist each government; it has little contact with private citizens or enterprizes. The treaty reflects the different economic and administrative systems of Finland and Russia. The arrangements with Norway took the form of individual treaties, each dealing with specific uses of only one watercourse; no joint commission was established. (Lynch-Wisconsin)
W80-00452

THE WORLD'S WATER IN A HUMAN PERSPECTIVE.
Holy See, Vatican City (Italy).
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 1941-1950.

Descriptors: *Water resources development, *Water management(Applied), *Human rights, *Water supply development, *Water shortage, *Social needs, Agriculture, Foods, Crop production, Droughts, Flood control, Irrigation, Rural areas, Water conservation, Public health, International cooperation.

This paper maintains that water supply is a human right, a factor which must be kept in mind in all efforts at water resources development. Water development issues affect the individual, such as: (1) community water supply; (2) agriculture, irrigation, and food production; (3) flood control; and (4) drought. A global study of water, such as the 1977 United Nations Water Conference, must consider the total environmental context and the dynamic ecological interrelationship between water and man. About 86% of the world population does not have access to local public water, which is a critical element in public health and economic development. In rural areas about two billion people live in great poverty; the international community must promote sound water management policies in its program to eradicate rural poverty. The long-term aim of irrigation schemes is self-

supporting agriculture, indispensable for true rural development. Several instances are cited to illustrate these concepts. (Lynch-Wisconsin)
W80-00453

WATER RESOURCES DEVELOPMENT, AND MANAGEMENT PLANNING IN ARID ZONES: CASE HISTORY-ISRAEL,
Tahal Consulting Engineers (Israel).
A. Wiener.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 2045-2058.

Descriptors: *Israel, *Water resources development, *Water supply development, *Water conservation, *Arid lands, *Planning, Irrigation, Regional planning, Model studies, Information exchange, Institutions, History, Networks, Lake Kinneret(Israel), National water carrier, Engineering, Water reuse, Recycling.

Systematic water resources development in Israel began with the first master plan draft completed in 1950. Planning has consisted of a successful combination of national systemic planning and regional project-by-project suboptimization. Israel currently uses about 95% of its conventional water resources (1650 million cu m); the remainder, mostly reclaimed and renovated municipal and industrial sewage, will be utilized within five years. A national water grid, consisting of local and regional schemes incorporat in underground, spring, and river waters, and renovated sewage flows, is fully integrated and controls two-thirds of the water supply; the rest is controlled through administrative allocation mechanisms. The schemes are interconnected through the National Water Carrier, a 20cu m/sec pipeline-tunnel-canal linking the central and southern coastal plain with Lake Kinneret (Sea of Galilee), a natural storage reservoir which serves as a seasonal and cyclical regulator. Technological approaches used include: (1) water conservation; (2) recycling and renovation of waste waters; (3) use of engineering to minimize waste and water losses, emphasizing irrigation efficiency; (4) substitution of alternative inputs or water-conserving investments for water; (5) manipulation of the hydrological cycle to improve net water yield, such as by cloud seeding, evaporation suppression, and improving runoff from noncultivated areas; and (6) use of physical, analog, and digital modeling tools. (Lynch-Wisconsin)
W80-00457

HYDROLOGICAL FORECASTING FOR OPERATIONAL PLANNING AND MANAGEMENT OF WATER RESOURCES,
For primary bibliographic entry see Field 2E.
W80-00467

RIVER BASIN PLANNING IN CANADA,
Department of the Environment, Ottawa (Ontario). Water Planning and Management Branch.
D. Bellinger.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 2341-2368.

Descriptors: *Canada, *Regional planning, *Comprehensive planning, *Water management(Applied), *River basin development, *Water resources development, Planning, Institutions, Administration, Governments, Federal government, Jurisdiction, Cooperation, Methodology, Analytical techniques, Eutrophication, Flood control, Water pollution control, Thames River Basin(Ontario, Canada), Qu'Appelle River Basin(Canada), Groundwater.

Planning has been used in Canada since the late 1960s to define and resolve river basin problems. Although Canada possesses abundant water, there are problems of poor distribution, low flow, flooding, inadequate groundwater, industrial pollution, and recreation. Planning and management techniques, methodologies, and experiences are described, and an appendix overviews 15 water resource planning studies. Initial emphasis on large structures in the first half of the 1960s, with planning and management left to provincial governments, gave way in mid-decade to a legislative and organizational approach in response to public concern for environmental degradation. The Canada Water Act of 1970 provided joint federal-provincial consultation on priorities, planning, and implementation of water programs, with emphasis on integrated, comprehensive management of natural resources. Joint participation by federal and provincial authorities overcomes the problem of divided jurisdiction and provides planning input of all financial contributors, public participation, and incorporation of national and regional priorities. Limitations include delays in implementation. Preplanning studies are useful for clarifying priorities, designing complete studies, and producing early cost estimates. (Lynch-Wisconsin)
W80-00472

IRRIGATION MANAGEMENT IN DEVELOPING COUNTRIES: A SUGGESTED ACTION PROGRAMME,
Overseas Development Inst., London (England).
For primary bibliographic entry see Field 3F.
W80-00481

AN ANALYSIS OF VALUES FOR DEVELOPMENT OF RECREATIONAL POLICY,
State Univ. of New York Coll. at Brockport.
D. L. Groves, and H. Kahalas.
International Review of Modern Sociology, Vol 8, No 1, p 103-112. January-June 1978. 27 ref.

Descriptors: *Recreation demand, *Valuation, *Policy, *Social values, *Methodology, *Behavior, Recreation, Recreation facilities, Governments, Decision making, Planning, Attitudes, Theoretical analysis, Sampling, Surveys, Evaluation, Public relations, Public sector, Land use, State College(PA), Pennsylvania.

To provide a sociological policy-making framework for public agencies in charge of managing recreational lands, core and peripheral values of the public were identified on the basis of cognitive, affective, and action-tendency components of user and general populations. A series of judgmental and situational independent variables were used to group these values and to identify significant relationships. A time budget was also used to assess behavioral patterns. A case study was undertaken at State College, Pennsylvania. Interviews were conducted based on a proportionate, stratified, random sampling technique. Factor analysis was used to select several independent variables for discriminant analysis. Significant relationships for the general population were found for symbolic meaning, sex, and age, and for users for use meaning, sex, free time, and residence. There was notably little relationship with behavioral variables, whereas situational and judgmental variables such as sex and meaning were important in forming an individual's priorities. Policy should be directed toward educational programs to help the public clarify its values relative to recreational lands. (Lynch-Wisconsin)
W80-00500

IMPLEMENTATION STRATEGIES FOR PUBLIC LAW 92-500, SECTION 208,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
For primary bibliographic entry see Field 6E.
W80-00524

APPROPRIATIVE WATER RIGHTS AND EFFICIENT ALLOCATION OF RESOURCES,
New Mexico Univ., Albuquerque.
For primary bibliographic entry see Field 6E.
W80-00548

IMPACT ASSESSMENT OF WATER RESOURCE DEVELOPMENT ACTIVITIES: A DUAL MATRIX APPROACH,
Fish and Wildlife Service, Kearneyville, WV. Water Resources Analysis.
For primary bibliographic entry see Field 6B.
W80-00550

SCREENING OBJECTIVES AND UNCERTAINTIES IN WATER RESOURCES PLANNING,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
P. H. Byer.
Water Resources Research, Vol. 15, No. 4, p 768-774, August 1979. 2 fig, 5 tab, 8 ref, 1 append.

Descriptors: *Screening models, *Water resources, *Alternative planning, *Uncertainties, *Objectives, Probability, Effects, Dams, Multiple-purpose reservoirs, Decision making, Equations, Mathematical models, Systems analysis, First-order estimates, Utilities, System attributes.

A procedure for helping analysts to choose the objectives and uncertainties to be considered in the evaluation of alternative system designs has been developed. Two models are described, one for screening system attributes (and their related objectives) and one for screening uncertainties about the levels of these attributes. The models use first-order estimates of utilities and probabilities to calculate a measure of the maximum expected effect on the results of the evaluation of not considering an objective or of assuming certainty, rather than uncertainty, about the levels of an attribute. The models are applied to the problem of planning a hypothetical multipurpose dam and reservoir system. (Bell-Graf--Cornell)
W80-00551

APPLIED WATER RESOURCE SYSTEMS PLANNING,
D. C. Major, and R. L. Lenton, Eds. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1979. 248 p.

Descriptors: *Water resources development, *Alternative planning, *Methodology, *Mathematical models, *Rio Colorado(Argentina), *Multiobjective, Simulation analysis, Optimization, River systems, Programs, Projects, Decision making, Economics, Engineering, Hydrology, Equations, Systems analysis, Screening model, Sequencing model.

Demonstrated is the application of water resource systems planning techniques to the Rio Colorado, Argentina. The goals of the Rio Colorado study, part of a broader contract to bring modern river basin planning methods to Argentina, were (1) to illustrate these methods via application and thus (2) to enable decision makers to understand the physical, economic, and social trade-offs involved in the choice of a development scheme for the river, thereby assisting them in choosing among alternative development plans. The book is organized into three parts. Part One provides the background to the study; a description of the Rio Colorado and its development sites; the authors' methodology, including multiple planning objectives and mathematical modeling; and an overview of the system models used to generate development programs for the river. Part Two contains descriptions of each of the four principal models used in the study; three were used to generate program alternatives--screening model, basic simulation model, and sequencing model--and one was used for data generation and model verification--the detailed simulation model. Part Three contains the parameter inputs to the models, model results, and interpretations of the work. Explained is the use of this book as a teaching aid. The modeling approach is to find development alternatives which maximize the economic and engineering benefits. (See also W80-00555 thru W80-00565) (Bell-Graf--Cornell)
W80-00554

THE RIO COLORADO BASIN,
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 13-28, 1979. 7 fig, 15 ref.

Descriptors: *Rio Colorado basin(Argentina), *Sites, *Water resources development, *Rivers, Irrigation, Power, Reservoirs, River flow, Interbasin transfers, Regions.

Provided is an overview of the Rio Colorado basin and a description of the potential reservoir, irrigation, power, and interbasin diversion sites along the river. The chapter has four sections: a general description of the Rio Colorado and its economy, and descriptions of each of the three main regions--the upper, middle, and lower basins--and the project sites contained in each. A map of the Rio Colorado basin and a profile of the river are given; presented also are maps of the three main regions and a figure showing the flow pattern of the river at Pichi Mahuida. (See also W80-00554) (Bell-Graf--Cornell)
W80-00555

PLANNING THEORY: MULTIOBJECTIVES,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
D. C. Major.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 29-36, 1979. 1 fig, 24 ref.

Descriptors: *Multiobjective theory, *Planning, *Water resources, Programs, Design, Optimization, Cost-benefit analysis, Benefit maximization, Regional analysis, Social aspects, Economics, Decision making, Rio Colorado(Argentina), Systems analysis.

Presented is an introduction to the use of multiple social, economic and regional objectives in water resources planning (rather than the single objective of maximizing 'economic' benefits as in traditional benefit-cost analysis). In general, multi-objective theory provides the basis for moving from the objectives of society to system design in an iterative fashion, using the four steps in system design suggested in 'Design of Water Resource Systems,' by Maass, et al. The theory is concerned with the choice of objectives, the development of alternative feasible plans responsive to objectives, and the final choice of a plan. Rules for counting national and regional benefits differ. Considered are the sectoral planning possibilities, the role of preferences in multiobjective theory, optimal program design, and applications of multiobjective planning. (See also W80-00554) (Bell-Graf--Cornell)
W80-00556

PLANNING THEORY: THE ROLE OF MATHEMATICAL MODELS IN WATER RESOURCES PLANNING,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
F. E. Perkins.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 37-46, 1979. 21 ref.

Descriptors: *Water resources, *Planning, *Mathematical models, *Optimization, *Simulation analysis, Rio Colorado(Argentina), Decision making, Systems analysis, Linear programming, Nonlinear programming, Dynamic programming, Integer programming, Multiobjective, Investment criteria.

Introduced is an approach to using mathematical modeling methods for water resources planning, and in particular, to the combined use of several types of models to generate alternative development configurations for a river. This approach is considered the second of two main conceptual bases for the study of Rio Colorado (the first being the use of multiple social, economic and regional objectives in water planning), and it can be related to the overall process of water resources planning in terms of the four steps in system design suggested in 'Design of Water-Resource Systems' by Maass et al, 1962. Certain characteristics of the water planning process are suggested, i.e., its dynamic nature, to define the role models should play within that process. Many models may be viewed as tools from which to derive answers to well-posed questions concerning system performance or behavior. The models must provide quantitative and sufficiently detailed information. Discussed are three valuable functions models can fulfill: amplification, organization, and evaluation. All mathematical models are constructed from three fundamental components: parameters, variables and constraints. Described is a categorization scheme for optimization models: linear programming; integer programming; nonlinear programming; and dynamic programming. Simulation models are categorized in terms of their likely components: inputs; physical relationships; nonphysical relationships; operating rules; and outputs. The chapter closes with a discussion of choosing the appropriate model for a particular situation. (See also W80-00554) (Bell-Graf--Cornell)
W80-00557

PLANNING FOR THE RIO COLORADO: AN OVERVIEW,
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 47-55, 1979. 2 fig, 6 ref.

Descriptors: *Rio Colorado(Argentina), *Alternative planning, *Methodology, *Mathematical models, *Multiobjective investment criteria, *River basins, Screening model, Sequencing model, Simulation model, Economics, Development sites, Systems analysis.

Presented is an overview of the methodology applied to the Rio Colorado (Argentina) in the joint study of the Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics and of MIT. The method entails: a series of models used to generate alternative plans for the river; and the multiobjective investment criteria embodied in the models. Described are the system of models used, the investment criteria, and a representation of the river basin and its potential development sites as used in the models. Included are a screening, a simulation, and a sequencing model. After discussing objectives for the Rio Colorado, the following multiobjective investment criteria are considered: benefit and cost accounting rules; interest rates; budget constraints; risk and uncertainty; pricing and cost allocation for multiobjectives; scheduling; and the relationship of sectoral planning to national parameters. (See also W80-00554) (Bell-Graf--Cornell)
W80-00558

THE MATHEMATICAL PROGRAMMING SCREENING MODEL,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
J. Cohon, T. Facet, and D. Marks.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 59-81, 1979. 9 fig, 1 tab, 46 equ, 4 ref, 2 append.

Descriptors: *River systems, *Planning, *Constraints, *Model studies, *Screening model, *Water resources, *Planning, Projects, Hydrologic aspects, Steady-state, Dams, Capital costs, Reservoir storage, Streamflow, Regression analysis, Mixed-integer programming, Algorithms, Equations, Systems analysis, Irrigation, Hydroelectric power, Optimization, Benefit maximization, Water policy, Conditionality.

The screening model described herein was used in the Rio Colorado study to choose initial configurations of plan elements, the most promising of which were subjected to further analysis by simulation. The steady-state model presented uses deterministic, mean hydrologic inputs. The projects selected in a given run are assumed to be implemented in the first year of a 50-year planning period, each year of which is taken to be the same hydrologically. Each year is composed of three 4-month seasons. The objective function is the maximization of net benefits; the formulation utilizes integer variables to represent dam capital costs, and for certain other purposes, and it is solved with a mixed-integer programming algorithm. The model is disaggregated into eight sections of the following constraints: continuity, reservoir, irrigation, hydroelectric energy, import/export, conditionality, and policy constraints, and finally the objective function; each of these aspects of the model is detailed. (See also W80-00554) (Bell-Graf--Cornell)
W80-00559

SIMULATION ANALYSES: THE BASIC MODEL,
Waterloo Univ. (Ontario) Department of Civil Engineering.
E. Mcbean, R. Lenton, and J. C. Schaae Jr.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 82-94 1979. 5 fig, 1 tab, 6 equ, 5 ref.

Descriptors: *Simulation analysis, *Model studies, *River systems, *Planning, *Screening model, *Rio Colorado(Argentina), Networks, Design, Reservoirs, Irrigation, Streamflow, Stochastic processes, Synthetic hydrology, Hydroelectric power, Equations, Effects, Benefits, Water allocation(Policy), Exports, Operating rules, Objective function.

The Rio Colorado study has introduced an approach for generating alternative river basin plans, combining the use of a screening, a simulation, and a sequencing model. The screening model is used to provide preliminary development configurations responsive to alternative objectives and constraints. The basic simulation model is a mathematical representation designed to estimate the contributions to objectives that would result if a proposed set of management and development measures was implemented. This chapter describes the background, general nature, and overall structure of the simulation model. Then the parts of the model representing irrigation, power, exports, water allocation rules, reservoir operating rules, and the objective function are characterized. These descriptions relate the details of the various components of the basic simulation model to those of the screening model; in each case, the differences are due primarily to the use of stochastic hydrology in the simulation model. Considered are: (1) the river system as a network of nodes; (2) synthetic streamflow; (3) the relationship of the two models; and (4) the parts of the model. A second, detailed simulation model has been developed for physical simulation of specific basin components and is described in a later chapter. (See also W80-00554) (Bell-Graf-Cornell)
W80-00560

SIMULATION ANALYSES: THE DETAILED MODEL,
Simon Bolivar Univ., Caracas (Venezuela).
For primary bibliographic entry see Field 2A.
W80-00561

THE MATHEMATICAL PROGRAMMING SEQUENCING MODEL,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering.
T. Facet, J. Cohon, and D. Marks.
In: Applied Water Resource Systems Planning, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 112-130, 1979. 8 fig, 22 equ, 6 ref, 2 appen.

Descriptors: *Model studies, *Alternative planning, *River basin development, *Water resources, *Sequencing model, Methodology, Equations, Mathematical models, Systems analysis, Irrigation, Projects, Constraints, Optimization, Benefit maximization, Power, Budget, Human population, Rio Colorado(Argentina).

Described is the model used to sequence alternative development plans for the Rio Colorado in Argentina. The planning methodology used for the river began with the application of a screening model and continued with the use of a basic simulation model designed to estimate the contributions to objectives that would result if a proposed set of managementand development measures were implemented. The result of applying these two models has been a set of projects, or basin confiurations, of determined sizes and locations. In the sequencing model, such a set of projects is scheduled optimally in four future time periods: The question is, During which time periods should they be constructed. With an objective function of benefit maximization, the model accounts for the following aspects in the scheduling: Decision benfits over time; budget contraints; constraints on the number of farmers available to work new irrigation areas; and project interrelationships such as the

necessity to ensure that an irrigation area is not built before the construction of a dam to supply it. Provided herein is a description of the general characteristics of this model, and then particular aspects of the model are discussed: Continuity constraints; the representation of irrigation and power projects; conditionality constraints; budget and population constraints; and the objective function.The article is followed by two appendices: (1) sequencing model formulation for an example configuration; and (2) list of symbols used in the sequencing model. (Janet Bell-Graf--Cornell
W80-00562

OUTPUTS OF THE MODELS,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
J. Cohon, T. Facet, W. Grayman, and G. Vicens.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 178-224, 1979. 7 fig, 45 tab, 1 append.

Descriptors: *River basin development, *Simulation analysis, *Model output, *Screening model, *Sequencing model, *Rio Colorado(Argentina), Methodology, River systems, Power, Irrigation, Economics, Projects, Efficiencies, Alternative planning, Optimization, Equations, Systems analysis, Multiobjective, Regional income, Sensitivity.

Described are outputs of the system of models used to generate program alternatives for the Rio Colorado; the purpose is to illustrate how the models reflect the physical and policy choices relevant to the development of the basin and to provide insight into the tradeoffs among these choices. First, reviewed briefly are the process and meaning of model use in the Rio Colorado study methodology. Then outputs of the three models are discussed, respectively: 21 screening runs, 4 simulation analyses, and 3 sequencing runs; accounted for are the Argentine objectives for river basin development. The schematic of the basin used in the models has been reproduced as an aid in interpreting results. The full results of the runs discussed are presented in tabular form in Appendix 11A for those who wish to analyze aspects of the results not discussed in the Chapter. (See also W80-00554) (Bell-Graf--Cornell)
W80-00565

OPTIMAL MANAGEMENT OF A MULTIRESERVOIR WATER SUPPLY SYSTEM,
IBM Scientific Center, Haifa (Israel).
For primary bibliographic entry see Field 4A.
W80-00583

DIGITAL MODEL OF THE HOLLISTER VALLEY GROUND-WATER BASIN, SAN BENITO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
G. W. Kapple.
Geological Survey Water-Resources Investigations 79-32 (open-file report), March 1979. 17 p, 3 fig, 6 plates, 9 ref.

Descriptors: *Model studies, *Aquifer characteristics, *Groundwater resources, *Groundwater availability, Water supply, Water demand, Projections, Pumping, Groundwater recharge, Water levels, Hydrogeology, Groundwater movement, Maps, Analytical techniques, California, *San Benito County, *Hollister Valley.

A two-dimensional finite-difference digital model was constructed to simulate effects of proposed pumping and recharge schemes on water levels in the Hollister Valley ground-water basin. Pumping rates in the valley are expected to increase from 24,000 acre-feet per year in 1968 to an ultimate rate of 38,500 acre-feet per year. The model was calibrated for the period 1940-51 and tested by simulating water-level changes from 1951 to 1968. Model-generated water levels were generally within 15 feet of observed water levels for the calibration period. For the testing period, computed and observed water levels differed by as much as 35 feet in parts of the study area. Discrepancies in the test results may be caused by errors in historical pumpage data or by unidentified faults or local semiconfined conditions. Under one proposed development scheme, model-predicted water levels to the year 2020 declined up to 170 feet in previously undeveloped areas. For developed areas near the city of Hollister, water-level declines of 100 to 125 feet were predicted for the same period. (Woodard-USGS)
W80-00756

DETERMINATION OF PEAK DISCHARGE FROM RAINFALL DATA FOR URBANIZED BASINS, WICHITA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
C. O. Peek, and P. R. Jordan.
Geological Survey open-file report 78-974, October 1978. 49 p, 8 fig, 6 tab, 19 ref, append.

Descriptors: *Peak discharge, *Rainfall-runoff relationships, *Storm runoff, *Urbanization, *Hydrographs, Design flood, Synthetic hydrology, Flood frequency, Evaluation, *Kansas, *Wichita(Kans).

Rainfall and runoff data from urbanized drainage basins in the Wichita area, Kansas, were used to evaluate the Soil Conservation Service synthetic-hydrograph method of computing flood hydrographs from rainfall data. The method was tested on six basins where the impervious surface ranged from 11 percent on the least urbanized basin to 40 percent on the most urbanized. Twenty-two of the largest storm events for which peak discharges had been observed were used in the test. After modification of the method for this particular area, results showed an average error of 20 percent, disregarding sign, with an apparent bias of 8 percent. However, uncertainties in some of the data make it impractical to adjust for bias. Application of the modified method using data on rainfall, impervious surface, soils, land use, channel slope, length of main channel, and drainage area is described for a hypothetical basin. As an alternative to more complete and complex modelling by digital computer, a peak discharge for drainage design can be calculated by applying the Soil Conservation Service method to a standardized 'design storm' for a specified recurrence interval. The method is sensitive to soil conditions and land use; therefore, accurate information on these factors is necessary. (Woodard-USGS)
W80-00774

6B. Evaluation Process

EVALUATION OF ECONOMIC BENEFITS OF HYDROLOGICAL SERVICES,
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 2, p 699-720.

Descriptors: *Cost-benefit analysis, *Hydrological services, *Data collections, *Institutions, *Monitoring, *Planning, Administrative agencies, Economics, Benefits, Hydrology, Water resources development, Costs, Water management(Applied), Forecasting, Governments, Flood control, Research and development, Data processing, Information exchange, Water allocation(Policy), Surface waters, Groundwater.

A national hydrological service and its associated observational network, usually a governmental agency, is an essential governmental service in every country. Crucial to water management success, and therefore strongly interrelated with the development rate of the national economy, the hydrological service should carry the responsibility for research and development, training, and international cooperation. Hydrological services usually: (1) supervise field measurements of surface water and groundwater; (2) maintain the data bank; (3) process, publish, and disseminate information; and (4) evaluate water resources. Some of these bodies are also responsible for: (1) planning of water resources development investments, (2) water allocation and usage control, (3) water resources management, (4) research, and (5) advising other organizations. The service generally provides information free of charge. Two methods of conducting a cost-benefit analysis of hydrological networks are outlined. Network equipment, data collection and processing, hydrological analysis and forecasting, training, research, international activities, and administration are discussed. While some benefits of hydrological services can be evaluated in monetary terms, many are intangible. Information made available for future planning is of great importance, but benefits cannot be quantified at the time data is collected. Well defined benefits include planning of water works and flood control. (Lynch-Wisconsin)
W80-00414

PRINCIPLES AND METHODS FOR THE PROVISION OF ECONOMIC INCENTIVES IN WATER SUPPLY AND WASTE WATER DISPOSAL SYSTEMS.
Economic Commission for Eurcpe (UN), Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 3, p 1323-1346.

Descriptors: *Methodology, *Incentives, *Economies, *Water supply, *Waste water disposal, *Water policy, Water management(Applied), Financing, Water supply development, Water utilization, Resource allocation, Water resources, Water demand, Use rates, Pollution taxes(Charges), Water pollution control, Polluter pays principle, River basins, Watersheds(Basins), Industrial water, Municipal water, Administrative agencies, Legal aspects, Sanctions.

The experience of member nations of the Economic Commission for Europe shows that economic incentives are necessary for balancing demand and supply in water resources management. This report presents an overview of the subject, conclusions, and a survey by country of the use of incentives in pollution control, water resources utilization, and stimulation of investments in water management development. Incentives in water pollution include: (1) payment for service rendered (price/cu m water), (2) indemnification for damage or legal violation (sanctions), and (3) direct and indirect economic incentives (charges, taxes, and tax abatement). In planned economies development of water management investment is entirely financed by the government, while in market economies local authorities and/or the state contribute loads, grants, or subsidies to construction. Conclusions: (1) An overall economic approach to water resources management is usually desirable at a certain stage in development, and is especially effective where formalized in a water act. (2) Administrative agencies are best organized by major watercourse basins. (3) Technical facilities are needed for supervision and control of incentives. (4) The 'polluter pays' principle is recommended. (5) While incentives for water quality protection are in wide use, incentives for more rational water use are in effect in few countries, but have been shown effective. (Lynch-Wisconsin)
W80-00436

METHODS FOR ESTIMATING GROUND WATER RESOURCES AND THE BALANCE OF SUBSURFACE WATERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
L. Alfoldi, E. Almassy, and P. Major.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1679-1692.

Because of basin structure, hydrogeological conditions in Hungary favor development of subsurface water resources which play an important role in domestic water supply. Subsurface waters will continue to be important due to good chemical-biological characteristics, protection from pollution, and poor distribution of surface water supplies. Total water demand in Hungary was 5.3 cu km in 1970, and is expected to increase to 12.5 cu km/yr by 1985, with domestic consumption increasing by over 100% from 0.5 to 1.1 cu km/yr.

In 1970 water was piped to 55% of the population, to be extended to 85% by 1985. Increased water demand will be met primarily by surface storage, and domestic increase from subsurface supplies. About 1000 new wells are drilled annually, increasingly concentrated in groups. Some industries (pharmaceutical, food) require subsurface supplies, mainly for water quality reasons. Hungarian water resources were first estimated in the National Water Management Master Plan, approved in 1964. In estimating groundwater resources, volume available has been considered that above the deepest level of normal groundwater fluctuations. Water resources of Karstified rocks have been estimated on the basis of long records of some 1200 springs and precipitation data. The water balance of subsurface waters, based on a simple comparison of supply estimates with water use, indicates that 25% of subsurface supplies are already engaged, surpassing 100% in some areas. (Lynch-Wisconsin)
W80-00440

FLOOD INSURANCE OR DISASTER LOANS: AN ECONOMIC EVALUATION,
M. J. Rettger, and R. N. Boisvert.
OWRT A-074-NY(3), 14-34-0001-7068.

Descriptors: *Disaster loans, *Flood insurance.

Alternative federal flood disaster assistance programs are evaluated through an economic comparison of flood insurance and disaster loan programs. The distribution of costs, benefits, and program transfers, both private and public, are simulated over time and are analyzed to determine the sensitivity of program performance to specific program parameters. Empirical results demonstrate that both programs provide adequate levels of protection at approximately equivalent costs. Variations in premium and interest rate subsidies have major effects on the distribution of total costs between the public and private sectors.
W80-00492

WATER RESOURCES AND THE NATION'S WATER SUPPLY: ISSUES AND CONCERNS,
General Accounting Office, Washington, DC.
Report No. CED-79-69, April 13, 1979, 63 p.

Descriptors: *Water resources, *Water supply, *Water supply development, *Water management, *Financing, Ground water resources, Water resources development, Water Resources Planning Act, Interstate compacts, Water conservation, Cost repayment, Cost sharing, Evaluation, Federal government, Administrative agencies, Water use, Industrial water, Planning.

The Federal role in water resources planning stems from the Water Resources Planning Act of 1965 (PL 89-80). The General Accounting Office's (GAO) role is the reassessment of national concerns; this report represents the perspective GAO is using to organize and direct audit efforts for water resources projects. Principal agencies involved in water resources activities are identified and major issues and concerns are presented. Current GAO efforts are centered on the impact on water supplies of industrial water reuse and recycling and Department of Agriculture efforts to promote better water management and conservation. In the area of municipal and industrial (M&I) water supply the GAO audit work includes a review of actions by metropolitan areas to meet water needs, survey of M&I water distribution systems problems in large M&I cities and study of M&I water supply problems for small and rural communities. Financing, cost sharing and repayment policies are addressed, as well as requirements for various Federal agencies and programs. Problems impacting on construction and maintenance of water resources projects are identified. Problems and issues concerning ground water resources are presented. For each area of concern, past and current GAO emphasis is presented and GAO studies and reports are identified. (Iervolino-NC)
W80-00542

WATER SUPPLY FOR URBAN AREAS: PROBLEMS IN MEETING FUTURE DEMAND,
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 6D.
W80-00543

COLORADO RIVER BASIN WATER PROBLEMS: HOW TO REDUCE THEIR IMPACT,
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-00545

WAYS TO RESOLVE CRITICAL WATER RESOURCES ISSUES FACING THE NATION,
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-00546

ANALYSIS OF OPERATIONS AND MAINTENANCE COSTS FOR MUNICIPAL WASTEWATER TREATMENT SYSTEMS,
Dames and Moore Water Pollution Control Engineering Services, Denver, CO.
Prepared for Environmental Protection Agency, Office of Water Program Operations, Washington, D.C., Report No. 430/9-77-015, February 1978. 265 p. 26 fig, 48 tab, 7 append.

Descriptors: *Wastewater treatment, *Treatment facilities, *Municipal wastewater, *Operating costs, *Maintenance costs, *Operation and maintenance, *Cost analysis, *Operations research, Economics, Costs, Sewerage, Methodology, Maintenance.

The purpose is to present the results and analyses of the most comprehensive survey made to date on the operation and maintenance (O&M) costs of the nation's municipal wastewater treatment plants and collection systems. The data for this study were gathered from a sample of 348 individual wastewater treatment plants and 155 sewer systems. Only treatment plants of 1.0 million gallons per day (mgd) capacity or larger were sampled. The cost data range from fourth quarter 1972 to first quarter 1977 and have been adjusted to third quarter 1977 dollars. The analyses in this study were performed with the assistance of a computer statistical package. The study quantified and confirmed certain economic principles relative to operating costs of process related facilities. The analyses indicate that the larger the plant, up to a limit of approximately .85 mgd, the lower the operation and maintenance costs per million gallons treated. For all types of treatment levels, personnel, power, and chemical expenditures accounted for approximately 80% of total operating costs. The total operating costs per capita are highest for sanitary sewer systems and lowest for a mixed system which has sanitary sewers plus storm sewer systems. The sanitary sewer system also has the highest per mile operating cost, and the mixed sewer system has the lowest maintenance cost per mile. (Iervolino-NC)
W80-00549

IMPACT ASSESSMENT OF WATER RESOURCE DEVELOPMENT ACTIVITIES: A DUAL MATRIX APPROACH,
Fish and Wildlife Service, Kearneyville, WV. Water Resources Analysis.
T. H. Yorke.
t No. FWS/OBS-78/82, September 1978. 27 p, 3 fig, 11 tab, 58 ref.

Descriptors: *Water resources development, *Fish and wildlife, *Water resources, Impacts, Water quality, Water quantity, Water flow, Impounded water, Control structures, Floodplains, Stream improvements, Channels, Beds(Stream), Channel erosion, Channel improvement, Levees, Dikes, Jetties, Locks, Dams, Bank stabilization, Flood protection, Flood control, Inter-basin transfers, Matrix system.

This report presents a dual matrix system for planning and evaluating the impact of water projects on fish and wildlife resources. The dual matrix system will (1) relate the resource development to physical change and then (2) relate the physical change to biological impact. The system utilizes the commonality of impacts on fish and wildlife resources associated with projects such as reservoirs, jetties and flood control levees. This report presents the first two components of the system--a general description of the system and a generalized matrix of the physical and chemical impacts of water resource development activities. Twelve water resource development activities are included in the matrix, and 10 physical-chemical characteristics are presented for each. Findings indicate that, in general, channel enlargement has many negative effects on a stream, increasing suspended solids and water temperature, and disrupting streambed equilibrium; channel realignment and clearing and snagging have somewhat less effect than enlargement; dikes and jetties can cause channel degradation; bank stabilization will tend to prevent natural stream migration and also deepen the channel; floodplain clearing may increase suspended solids and accelerate bank erosion; flood control impoundments will virtually halt all natural movement of bed material, as will hydroelectric impoundments, locks and dams; and that transbasin augmentation will accentuate velocity extremes of the stream. (Arnold-NC)
W80-00550

ECONOMIC PARAMETERS,
Institute of Water Economics, Law, and Administration (Argentina).
J. Pascuchi, W. Grayman, J. Suarez, and D. C. Major.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood, Cliffs, New Jersey, p 133-148, 1979. 2 fig, 5 tab, 11 ref.

Descriptors: *Methodology, *Mathematical models, *Irrigation, *Energy, *Benefits, *Economic parameters, Water resources development, Planning, Rio Colorado(Argentina), Costs, Estimating, Regional income, Opportunity costs, Imports, Exports, Shadow price, Systems analsis, Equations.

A planning methodology has been derived for the Rio Colorado in Argentina which utilizes a screening model, a basic simulation model, and a sequencing model for deriving optimal water resources management alternatives. This chapter explains the methods used to derive the principal economic parameters required by the models. These parameters include: benefits for irrigation and energy, including benefits from the export of water to the Rio Atuel basin, Mendoza; the opportunity costs of imports from the Rio Negro system; regional income costs and benefits; the shadow price on foreign exchange; and budget and population limits on development. The values of the parameters in each section are presented in terms of the model parameter notation used for the screening and simulation models. The planning horizon used for the calculation of benefits and costs is 50 years. (See also W80-00554) (Bell-Graf--Cornell)
W80-00563

ENGINEERING AND COST PARAMETERS,
Gates (W. E.) and Associates, Cincinnati, OH.
W. Grayman.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood, Cliffs, New Jersey, p 149-174, 1979.

Descriptors: *Estimating, *Water resources development, *Alternative planning, *Engineering parameters, *Cost parameters, *Streamflow data, *Projects, Reservoirs, Irrigation, Data collections, Evaporation, Depth, Constraints, Simulation analysis, Screening model, Powerplants, Mathematical models, Systems analysis, Equations, Physical aspects, Structural aspects.

Described is the estimation of the engineering and cost parameters used in the series of three models employed to generate program alternatives for the Rio Colorado in Argentina. The chapter is divided into three sections; the first relates to streamflow data estimation and generation. The second section considers the estimation of physical and structural parameters of the potential projects in the basin,

including: reservoir area--depth and volume--depth curves; reservoir evaporation data; irrigation parameters; hydroelectric powerplant parameters; and upper bounds on project sizes. The final section deals with project cost estimates; considered are reservoir, powerplant, irrigation, and import and export costs. The parameter values given are presented in terms of the parameter notation used for the screening model and the basic simulation model developed for the Rio Colorado study. A short appendix written by D. Valencia and J. C. Schaake, Jr. follows this chapter, illustrating the streamflow augmentation procedure used in the study. (See also W80-00554) (Bell-Graf--Cornell)
W80-00564

SOCIO-ECONOMIC RELATIONSHIPS FOR WATER-BASED RECREATION INVOLVEMENT IN INDIANA,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. T. O'Leary, and F. D. Dottavio.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-105125, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No. 125, September 1979. 71 p, 1 fig, 18 tab, 45 ref, 1 append. OWRT A-051-IND(3).

Descriptors: *Recreation demand, *Water sports, *Social participation, Recreation, Recreation facilities, Social aspects, Social impact, Economics, *Socioeconomic relationships, Water-based recreation, Recreation activity.

The research objectives were to determine who was participating in water based recreation in Indiana, examining profiles of the participants, and ascertain the change from 1972 to 1976. It was apparent that virtually all water recreational activities are done in groups of more than one. Yet most user data emphasized the individual visitor as the focal point. Social groups and age appear most promising in understanding involvement in water based recreation. Another facet of the research concentrated on activity clusters identified through factor analysis. Water activities tend to cluster in patterns. These patterns establish a basis for looking at the relationship between activities within a cluster (participants, profiles, resource needs, etc.) and between clusters. The process is being used on the 1977 Heritage Conservation and Recreation Service National Outdoor Recreation Survey of the general public at national and regional levels to examine clustering of activities.
W80-00636

APPLICATION OF GEOSCIENTIFIC KNOWLEDGE TO EVALUATION OF LAND AND WATER RESOURCES IN SOME DESERT AREAS OF EGYPT,
Egyptian Desert Inst., Cairo.
A. A. Shata.
Advances in Desert and Arid Land Technology and Development, Vol. 1, Adli Bishay and Wm. G. McGinnies, eds. Harwood Academic Publishers, 1979, p 183-200, 18 fig.

Descriptors: *Egypt, *Hydrography, *Geohydrologic units, *Geochemistry, *Structural geology, Land resources, Water resources development, Arid lands, Economic analysis, Balance of nature.

Over the past 20 years certain desert areas of Egypt have been considered for agricultural development either through use of available groundwater and surface runoff water or of Nile water. Accordingly, the available natural resources of these areas are evaluated here through the application of geoscientific approaches including hydrostratigraphy, hydrostructure, hydrology and hydrogeochemistry. While field and laboratory investigations have brought to light much information about the potentials of both water and land resources in the Mediterranean Littoral Zone, the fringes of the Nile Delta, the Sinai Peninsula, the Western Desert Depressions, the High Dam Lake fringes and the Red Sea- Gulf of Suez Foreshore Areas, it is emphasized that (1) water and land resources are available in almost all these areas but for agricultural development there is need to consider the ecological balance and the economics of development, and (2) cooperation between research institutions and development organizations must be strengthened in order to help solve immediate problems. (Tickes-Arizona)
W80-00639

WATER RESOURCES AND LAND RECLAMATION IN EGYPT,
General Co. for Research and Groundwater, Cairo (Egypt).
M. M. Seddik, and S. Shafei.
Advances in Desert and Arid Land Technology and Development, v. 1, Adli Bishay and Wm. G. McGinnies, eds. Harwood Academic Publishers, 1979. p 201-210, 4 tab.

Descriptors: *Water resources development, *Egypt, *Comprehensive planning, *Groundwater availability, *Water supply, Water utilization, Land reclamation, Land management, History, Rainfall, Runoff, Irrigable land, Irrigation water.

The development and utilization of Egypt's water resources, including Nile water, groundwater, and rainfall are discussed here in relation to the horizontal expansion of land in Egypt from the 19th century to present. An analysis of this expansion, summarized and traced here in terms of the period before 1900, 1900-1920, 1920-1964, and 1964-1972, indicates that today an estimated 25 million cu. m/year of groundwater is available, sufficient for the irrigation of 5000 feddans of olives, almonds, and fig trees along with rainfall and runoff sufficient for 135,000 feddans yearly. (Trickes-Arizona)
W80-00643

LARGE ARRAY OF WASTEWATER REUSE OPTIONS FOR PIMA COUNTY, ARIZONA,
Army Corps of Engineers, Los Angeles, CA.
M. F. Thuss.
Pima Association of Governments, 208 Project, Element 6, Task 6340, May 1978. 86 p, 12 fig, 30 tab, 11 ref.

Descriptors: *Water reuse, *Waste water disposal, *Waste water treatment, *Planning, *Project planning, *Regional analysis, *Competing uses, Water utilization, Reclaimed water, Alternative planning, Comprehensive planning, Water allocation(Policy), Irrigation water, Industrial water, Municipal water, Recreation, Drainage area, Water quality, Water supply, Pima County, Arizona.

The Pima Association of Governments 208 project's land use, economic and population projections along with the water use rates developed in Task Reports 6320 and 6330 are used in this analysis to identify sources of wastewater for irrigation, industrial, municipal, and recreational reuse in the Ajo Area, the Avra and Altar Valley Area, the Upper and Lower Santa Cruz area and the Upper and Lower San Pedro area. With the purpose of identifying a wide range of wastewater reuse options those potential sources are identified and discussed in terms of their volume, quality and location requirements. As the first step in developing a preferred plan for wastewater reuse in Pima County, Arizona this report examines current reuse practices, public opinion trends, reuse programs outside Pima County and proposed uses in an attempt to provide both the necessary background information and a preliminary analysis of all alternatives investigated. (Tickes-Arizona)
W80-00646

PROJECTED WATER USE AND WATER BUDGET CALCULATIONS FOR PIMA COUNTY, ARIZONA,
Army Corps of Engineers, Los Angeles, CA.
M. F. Thuss.
Pima Association of Governments, 208 Project, Element 6, Task 6330, Future Water Use Overview, April 1978. 69 p, 25 tab, 3 fig, 8 ref.

Descriptors: *Water utilization, *Hydrologic budget, *Water supply, *Competing uses, *Forecasting, *Alternate planning, Irrigation water, Municipal water, Industrial water, Recreation, Regional analysis, Drainage area, Return flow, Pumping, Recharge, Planning, Comprehensive planning, Pima County, Arizona.

Based upon the water supply and demand estimates established in The Water Supply Overview (Task Report 6310) and The Water Use Overview (Task Report 6320), an attempt is made here to calculate the present and future water budgets for Pima County, Arizona. Both historic and current agricultural, municipal, industrial and recreational water use is reported for the Ajo, Avra and Altar Valley, Upper and Lower Santa Cruz and Upper and Lower San Pedro areas and analyzed to determine the following rates of use: pumpage, return flow, recharge, flows and consumption. Once future water use projections are made they are compared with water supply information to establish water budgets for the projected planning period. It is concluded that the water budget for Pima County indicates an overall decline in annual water consumption from 337,900 acre-feet in 1975 to about 173,900 acre-feet in 2000 based upon the main assumption that cropped acreage will decrease from over 55,000 acres in 1975 to about 10,600 acres in 2000. It should be noted that at no time does dependable supply equal or exceed consumption and that these calculations do not consider the effects of water importation, conservation or wastewater reuse programs. (Tickes-Arizona)
W80-00647

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

WORLD BANK: PRICING AS A MEANS OF CONTROLLING THE USE OF WATER RESOURCES.
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 2, p 659-668.

Descriptors: *Economics, *Pricing, *Water conservation, *Water demand, *Water supply, *Water utilization, Regulation, Water resources, Policy, Hydroelectric power, Irrigation, Municipal water, Water pollution control, Water management(Applied), Marginal costs, Alternative planning, Economic efficiency, Equity, Resource allocation, Costs.

Water pricing policies which reflect real resource costs incurred as a result of additional consumption rather than of historical costs associated with supply of water-related services, can prevent wasteful use of scarce water resources. This paper discusses pricing in regard to: (1) hydroelectric power, (2) municipal water supply, (3) irrigation, and (4) water pollution control. Common to pricing of all of these uses is resolution of conflicts among various objectives of pricing policy. Relevant costs are the value of the water resources which are made unavailable for other purposes because of that specific use. Costs of future systems expansion are important, while sunk costs are irrelevant. Engineering cost estimates, not historical accounting costs, are required. Real costs should be reflected in the charges which affect user choices, requiring: (1) low charges when additions to capacity can be provided cheaply, (2) an incentive to reduce industrial effluent strength when this would produce savings in treatment, and (3) a greater incentive to reduce water or electricity consumption in summer if capacity and costs are tied to summer use. The role of pricing stressed here is that of influencing consumer behavior to reduce wasteful water use or to achieve water conservation. Estimation of incremental costs is an important element of water resources management, useful either as a basis for establishing price or as a benchmark with which to evaluate social or other goals. (Lynch-Wisconsin)
W80-00411

WORLD BANK: AN APPROACH FOR SELECTION OF LABOUR VS. CAPITAL INTENSIVE TECHNOLOGIES FOR WATER RESOURCE DEVELOPMENT PROJECTS.
In: Water Management and Development, Pro-

ceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 669-684.

Descriptors: *Methodology, *Labor-intensive, *Capital-intensive, *Technology, *Design, *Employment, *Water resources development, Economic development, Developing countries, Project planning, Planning, Alternative planning, Economics, Civil engineering, Public works, Dams, Reservoirs, Irrigation canals, Unemployment, Underemployment, Equity, Trade-offs, Economic efficiency, Optimization, Labor, Capital, Analytical techniques, Income distribution, Resource allocation.

Labor-intensive construction can be economically efficient as well as technically feasible in public water resources development projects, such as dams, reservoirs, and irrigation channels, depending on: (1) technology employed, (2) project organization and management, (3) labor supply conditions, (4) health and nutrition of workers, and (5) project design. Most developing countries have problems of employment and underemployment in rural areas; civil works based on labor-intensive technology can help generate employment, while fostering economic development with distributional equity. For a given facility both technology and design should be regarded as variable rather than fixed, and for a given design the only relevant trade-off is the relative cost of capital-intensive or labor-intensive technology, assessed by social accounting prices if they diverge from market prices. Broadly speaking, in countries with wage rates less than US $1/day, labor-intensive methods can be fully competitive with modern equipment, provided the constraints mentioned above are satisfied. Proper organization and management capabilities are particularly important if efficient labor-intensive methods are introduced on a large scale. Great emphasis must be placed on the skill requirement and the institutional framework for project execution if labor-intensive methods are to be economical. Two case studies of labor-intensive irrigation projects are presented, for a major and a minor irrigation channel. (Lynch-Wisconsin)
W80-00412

RESTRICTION OF SUPPLY AND RISK IN WATER SUPPLY SYSTEMS,
Research Inst. for Water Resources Development, Budapest (Hungary).
M. Domokos, and S. Szabo.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1711-1732.

Descriptors: *Water supply, *Risks, *Economics, *Water demand, *Probability, Water management(Applied), Analytical techniques, Methodology, Optimization, Systems analysis, Mathematical studies, Mathematical models, Model studies, Marginal use, Equations, Incentives, Policy, Uncertainty, Planning, Estimating, Decision making, Irrigation, Hungary, Water supply restriction, *Water balance.

Rising costs of maintaining water supply systems has focused attention on restricting consumption rather than completely meeting peak demand. This paper analyzes monetary risks resulting from supply restrictions and from unused capacity. Where mathematical represention of actual systems or a lack of information create difficulties, the water balance is more appropriate than systems analysis, although not as reliable. In the water balance, the water resources situation within a particular unit is described by a single index number representing marginal use, the supply restriction number. The situation is considered acceptable if the index is smaller than the limit value (the water shortage tolerance) specified by economic considerations. There are three types of coincidence between available resources and demand: (1) demand is constant, (2) there is an acceptable deterministic functional relationship between the two variables, or (3) the coincidence is stochastic, describable by a joint relative frequency function. Risk estimation by probability theory is the logical choice for economic activities subject to hydrological effects. Computation of risk indices is based on simulated time series of the operational model of the water supply system. A risk fund is needed to compensate losses. Application to a Hungarian irrigation water supply project is described. (Lynch-Wisconsin)
W80-00442

WATER FOR DOMESTIC USE IN RURAL AREAS - THAILAND,
Department of Public Works, Bangkok (Thailand). Rural Water Supply Div.
For primary bibliographic entry see Field 6D.
W80-00448

6D. Water Demand

WATER FOR AGRICULTURE.
Food and Agriculture Organization of the United Nations, Rome (Italy).
For primary bibliographic entry see Field 4A.
W80-00424

REPORT ON COMMUNITY WATER SUPPLIES,
World Health Organization, Geneva (Switzerland).
For primary bibliographic entry see Field 5F.
W80-00427

WATER FOR THE THOUSAND MILLIONS,
Intermediate Technology Development Group, London (England).
For primary bibliographic entry see Field 6A.
W80-00432

WATER FOR DOMESTIC USE IN RURAL AREAS - THAILAND,
Department of Public Works, Bangkok (Thailand). Rural Water Supply Div.
L. Chainarong.
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1835-1846.

Descriptors: *Thailand, *Rural areas, *Domestic water, *Water supply development, *Pipelines, *Financing, *Planning, Regional planning, Developing countries, Wells, Pumps, Use rates, Meters, Costs, Design criteria, Training, Institutions, Administrative agencies, Governments.

Thailand's rural water supply program will provide a safe domestic water supply for the entire rural population of some 32 million, 77% of the total Thai population. To date, water systems have been provided for about 17% of the rural population (communities of under 5000), and a goal of 25% has been set for 1980 focusing on smaller communities. Planning, implementation, and financing are responsibilities of several government agencies. Liaison is maintained through a National Committee composed of representatives from each implementing agency, the National Planning Agency, and the Budget Bureau. Water systems include piped systems, deep tube wells (80-100 m), tube wells with hand pumps, small-diameter shallow tube wells, and rainwater storage tanks. For piped systems construction costs are jointly financed by the national and local governments while tube wells and hand pumps are financed in full by national government subsidies. In areas with piped systems, consumers are required to pay for the water at a fixed monthly rate per household, and householders also pay for the water outlet. Water meters introduced experimentally in selected areas for house connections are well-received, facilitate water rate collection, ensure regular minimum operating funds, and reduce wastage of water and plant operation. Training courses are conducted for water and treatment plant operators, and assistance from international organizations has been received. (Lynch-Wisconsin)
W80-00448

ISRAEL- A MODEL OF EFFICIENT UTILIZATION OF A COUNTRY'S WATER RESOURCES,
Ministry of Agriculture, Tel-Aviv (Israel).
For primary bibliographic entry see Field 6E.
W80-00471

U.S. INLAND WATER TRANSPORTATION,
Department of Transportation, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-00473

INTER BASIN WATER TRANSFERS IN SOUTH AFRICA,
Department of Water Affairs, Pretoria (South Africa).
T. P. C. Van Robbroeck.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2563-2582.

Descriptors: *South Africa, *Water transfer, *River basins, *Water supply development, *Dams, Rivers, Reservoirs, Water storage, Water shortage, Municipal water, Powerplants, Orange River (South Africa), Fish River (South Africa), Sundays River (South Africa), Tugela River (South Africa), Vaal River (South Africa), Irrigation, Pumping, Pipelines.

Large-scale inter-basin transfer of water can correct geographic imbalances between water supply and demand. This paper describes several projects for water transfer in South Africa, primarily: (1) the Tugela Vaal project, (2) eastern Transvaal coal-fields water supply, and (3) the Orange-Fish-Sundays diversion. Projects mentioned briefly are Vaal-Gamagara, Springbok, and Theewaterskloof; several other are in palnning. Exploitable water in South Africa is poorly distributed. By the late 1960s in the Pretoria-Witwatersrand-Vereeniging complex (population 4.5 million) the Vaal and Bloemhof Dams could not meet future demands, and it was decided to import water from the neighboring Tugela River catchment via storage in the Sterkfontein Dam, a specially constructed reservoir. In the eastern Transvaal coal fields, water had to be imported from the Komati catchment to cool a large pit-head coal-fired power station; water in the area of the station is scarce. A regulating dam was built to a capacity of 84 million cu m. When additional power stations were built another dam was constructed further down the river. A 1962 plan for development of the Orange River included a proposal to divert 849 million cu m/yr of water via a tunnel to the Fish and Sundays Rivers for irrigation and water supply. (Lynch-Wisconsin)
W80-00483

WATER USAGE PROFILE-FORT CARSON CO.,
Construction Engineering Research Lab. (Army), Champaign, IL.
J. E. Matherly, N. J. Staub, L. J. Benson, and R. J. Fileccia.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A053 227, Price codes: A04 in paper copy, A01 in microfiche. Interim Report N-34, March 1978. 57 p, 6 tab, 1 append.

Descriptors: *Military reservations, *Water demand, *Irrigation, *Domestic water, *Fort Carson, Colorado, Water conservation, Water utilization, Irrigation water, Current meters, Water measurement, Lawns, Water users, Irrigation practices, Water rates, Colorado Springs(CO).

Family housing water usage (600 gal capita d) at Fort Carson military installation, Colorado, greatly exceeds normal family housing water usage of 50-100 gal capita d. Based on limited on-site observations, the unexpectedly high average daily water usages reflect extensive lawn and garden irrigation. Fort Carson water usage increased from 2.71 mg d in 1970 to 3.68 mg d in 1976. Much of the 36% increase results from several family housing units constructed between 1971 and 1974. The study's

objectives were to provide current Fort Carson water usage data, evaluate it, and appraise monitoring data acquisition techniques. Barracks, family housing units, commercial, industrial, and recreational facilities at Fort Carson were equipped with water meters and data collection continued from March to July, 1977. Fort Carson is probably unique in the large amounts of domestic water used for irrigation. Information on civilian water demands in nearby Colorado Springs must be compared with Fort Carson water demands. Current manual data collection methods are satisfactory; however, automated methods will be required to obtain more continuous data. (Danovich-Wisconsin)
W80-00494

URBAN RESIDENTIAL DEMAND FOR WATER IN THE UNITED STATES,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
H. S. Foster, Jr., and B. R. Beattie.
Land Economics, Vol. 55, No. 1, p 43-58, February 1979. 3 fig, 4 tab, 27 ref.

Descriptors: *Water demand, *Water users, *Model studies, Water allocation(Policy), Water distribution(Applied), Economics, Water management(Applied), Water policy, Water requirements, Water supply, Water utilization, Water rates, Income analysis, Social aspects, Rainfall, Seasonal, Domestic water, Residential use, Cities.

It is argued that a general urban residential water demand model applicable to the entire continental U.S. can be formulated and that such demand may be estimated using price, rainfall, income and population per water meter as independent variables. This study specifies and estimates parameters for an improved Fourt-type model of demand. Fourt's (1958) method was based on two models. The first included price, number of summer rainfall days and average number of persons served per meter. The second model used price, per-capita income and percentage of dwellings comprising three or more habitation units. The model tested in this study improves on the Fourt models by combining the most useful parameters from each and omitting irrelevant or improperly specified variables. The new model is stated as Q=f(P,Y,R,N). Q represents quantity of water per household, i.e., per meter (1000 c ft yr); P is average water price (dollars per 1000 c ft); Y is median household income (dollars yr); R is precipitation (inches) during defined growing season; and N is average number of residents per water meter. Each parameter was separately tested for statistical fit against empirical data, and elasticity estimates of the overall model compared favorably with those of previous studies made of separate U.S. geographic regions. (Harris-Wisconsin)
W80-00495

LONG-TERM AVAILABILITY OF WATER RESOURCES FOR ENERGY DEVELOPMENT IN THE CENTRAL UNITED STATES,
Argonne National Lab., IL. Energy and Environmental Systems Div.
L. J. Habegger, S. Y. Chiu, and L. J. Hoover.
Prepared for 5th National Conference on Energy and the Environment, Cincinnati, Ohio, October 31-November 3, 1977. 6 p, 1 fig, 1 tab, 3 ref.

Descriptors: *Water demand, *Water utilization, *Energy, *Central US, *Electric powerplants, Water policy, Water allocation(Policy), Great Lakes Region, Great Plains, Planning, Irrigation, Competing uses, Water consumption, Electric power demand, Water shortage.

Cumulative water supplies are adequate in the Central U.S. region to satisfy energy requirements and other uses, but some subregions exist in which moderate to severe water shortages are likely. The overall region includes the Great Lakes, Mississippi River and its tributaries, the Ohio, Missouri, Illinois, and Arkansas Rivers. Total regional energy demand has been forecast to double every 35 years, although growth rate has declined. Total energy-related water consumption is estimated at 2,044 cfs for 1985, 4,410 cfs for 2000, and 11,700 cfs for 2020; existing plants use 835 cfs. Estimates include fossil and nuclear power plants and synfuel plants. Total water consumption by existing competing withdrawal users was 38,000 cfs in 1975 and is expected to increase to 43,000 cfs by 1985, 47,000 cfs by 2000, and 55,000 cfs by 2020. Irrigation is the largest water demand, consuming more than 70% of the 1975 regional total. About 77%, or 9,000 cfs of the 2020 year total regional energy development water requirement could be obtained without creating major water shortages for other users. Water shortages are potentially so severe in Arkansas River Basin in Kansas and Platte River Basin in Nebraska that siting energy facilities are prohibitive unless drastic measures are used, such as interbasin transport, limiting other users' allocation, or dry cooling. Regional energy and water resources planning integration is essential. (Danovich-Wisconsin)
W80-00499

PLANNING STATUS REPORT, WATER RESOURCES APPRAISALS FOR HYDROELECTRIC LICENSING: LOWER ARKANSAS RIVER BASIN-ARKANSAS, COLORADO, KANSAS, NEW MEXICO, OKLAHOMA AND TEXAS,
Federal Energy Regulatory Commission, Washington, DC. Office of Electric Power Regulation.
Revised 1979. 17 p, 2 fig, 7 tab. DOE/FERC-0034.

Descriptors: *Water resource planning, *Water resource development, *Water projects, *Hydroelectricity, *Reservoir projects, *Arkansas River Basin, *Multiple purpose projects, Planning, Reservoirs, Dams, Water quantity, Inter-basin transfers, Water supply, Governments, Water supply development, Feasibility studies.

This is one of several revised Planning Status Reports for major river basins of the United States. Encompassing six south central and western states, the Lower Arkansas River Basin covers 104,389 square miles, and ranges in elevation from 8,000 feet in New Mexico to 100 feet at the Mississippi River confluence. The basin's rainfall varies from abundant in the east to arid in the west. The area has extensive natural resources, most notably petroleum and gas. The 1971 population totaled approximately 3,100,000. Fifty-six reservoirs are either in place or under construction in the basin; seven existing hydroelectric projects in the lower portion of the basin total 588,000 kilowatts of capacity. Steam electric capacity for the basin is projected to be about 17,124, 000 kilowatts (KW) by 1985, with 30% of this being nuclear power, and 40,394,000 KW by the year 2000, with 54% being nuclear power. Current planning efforts are directed toward improved flood control, construction of multi-purpose projects, and trans-basin water conveyance from the basin to more arid regions. No hydroelectric projects have been approved for the basin, but potential hydroelectric and thermal generating projects are presented. (Arnold-NC)
W80-00533

WATER SUPPLY FOR URBAN AREAS: PROBLEMS IN MEETING FUTURE DEMAND,
Comptroller General of the United States, Washington, DC.
Report No. CED-79-56, June 15, 1979, 50 p, 1 append.

Descriptors: *Water supply, *Water resources management, *Water use, *Water quantity, *Water demand, *Water resources, Water resources development, Water policy, Water reuse, Water consumption, Groundwater, Desalination, Conservation, Water supply development, Supply, Interbasin transfers.

This study outlines and analyzes urban water supply/demand problems for the U.S. Increasing population and rising demand will mandate more stringent conservation measures with a projected U.S. population of 268 million by 2000. Of particular concern is the accelerating extraction of groundwater, particularly in the arid West. Discussions were held with Federal, State and local officials in developing this report. Findings include: less streamflow reliability in the future for Western cities, and increasing numbers of streams with supplies already fully allocated to local urban areas, and increased pollution of urban water from agriculture and mining. Distribution system problems are discussed and institutional and legal constraints are presented. Fourteen major urban areas were examined to determine what each was doing to assure an adequate future water supply. All areas projected the need for additional water supplies by 2000. Many have instituted only emergency measures, such as interbasin water transfers, to alleviate current problems. Such interbasin transfers may become the rule for most large urban areas for an interim period; no obvious solutions are in sight, but steps such as desalination, wastewater reuse, conservation, and some supply increase may be feasible. (Arnold-NC)
W80-00543

COLORADO RIVER BASIN WATER PROBLEMS: HOW TO REDUCE THEIR IMPACT,
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-00545

APPROPRIATIVE WATER RIGHTS AND EFFICIENT ALLOCATION OF RESOURCES,
New Mexico Univ., Albuquerque.
For primary bibliographic entry see Field 6E.
W80-00548

AN ANALYSIS OF RESIDENTIAL DEMAND FOR WATER USING MICRO TIME-SERIES DATA,
North Carolina State Univ. at Raleigh. Dept. of Economics and Business.
L. E. Danielson.
Water Resources Research, Vol. 15, No. 4, p 763-767, August 1979. 3 tab, 24 ref.

Descriptors: *Water demand, *Residential, *Time series analysis, Statistical methods, Estimating, Seasonal, Sprinkling, Systems analysis, Equations, Price elasticity, Income elasticity, Econometric model, Raleigh(NC).

This paper presents the results of a study of a time series of cross-sectional observations on water demand at the household level utilizing an econometric model for pooled cross-section and time-series data. Checks for multicollinearity, serial correlation, and heteroskedasticity are made to insure that the methodology is consistent with the assumptions required for obtaining unbaised estimates of parameters and standard errors. Residential water demand is estimated as a function of temperature, rainfall, house value, water price, and household size using monthly meter readings from 261 residential households in Raleigh, North Carolina, between May 1969 and December 1974. Demand relations are estimated for total residential, winter, and sprinkling demands. Sprinkling use per period per customer for each year is estimated by subtracting winter (November-April) from summer (May-October) use. Household size explains the largest proportion of the variation in the data. Estimated sprinkling demand is found to be highly responsive to changes in water price and the level of the climatic variables, while total residential demand and winter demand are less responsive to price changes. (Bell-Graf–Cornell)
W80-00599

A COMPARATIVE ANALYSIS OF MULTI-SOURCE WATER SUPPLY DATA FOR PIMA COUNTY, ARIZONA,
Army Corps of Engineers, Los Angeles, CA.
M. F. Thuss.
Pima Association of Governments 208 Project, Element 6, Task 6310, Existing Water Supply Overview, April 1978. 152 p, 51 fig, 11 tab, 33 ref.

Descriptors: *Water supply, *Water yield, *Forecasting, *Hydrologic data, *Water resources development, *Water supply development, *Hydrologic budget, *Water utilization, *Regional analysis, Water yield improvement, Storage, Alternative planning, Comprehensive planning, Legal con-

straints, Water quality, Recharge, Pima County, Arizona.

An overview of the water supply data for Pima County, Arizona, is presented which centers on identifying the best estimates of the total amount of recoverable water in storage and the yearly dependable supply in 4 major areas of Pima County in an effort to establish the supply element for future budget calculations. While no attempt is made here to determine if an identified water supply potential can, in reality, be efficiently developed, the specific objectives of this overview report are: to identify and describe (1) previously published reports related to water supply in the study area, (2) areas which hold minimum potential for water supply development, (3) areas having potential for water supply development, (4) to determine and define legal and quality constraints to water supply development, and (5) to determine and define the most reasonable estimates of recoverable water in storage and natural average annual recharge for those areas having potential for water supply development. (Tickes-Arizona)
W80-00644

WATER WITHDRAWALS IN ILLINOIS, 1978,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W80-00722

6E. Water Law and Institutions

POLICY OPTIONS,
For primary bibliographic entry see Field 6A.
W80-00404

PRESENT AND FUTURE ACTIVITIES OF THE UNITED NATIONS SYSTEM IN WATER RESOURCES DEVELOPMENT.
For primary bibliographic entry see Field 6A.
W80-00405

WORK OF THE INTERNATIONAL LAW COMMISSION ON THE LAW OF THE NON-NAVIGATIONAL USES OF INTERNATIONAL WATERCOURSES.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 871-906.

Descriptors: *International waters, *International law, *River basins, *Lakes, *Water resources development, *International Law Commission, International cooperation, Treaties, Legal aspects, International commissions, United Nations, Environmental effects, Water pollution effects, Canals, Basins, Rivers, International relations.

Pursuant to a 1975 United Nations resolution requesting the International Law Commission to give priority to developing and codifying the law of the non-navigational uses of international watercourses, the Commission undertook such a study in the same year. This paper presents a brief introduction followed by two appendices: (1) Chapter V of the International Law Commission's report on its 28th Session (1976) pertaining to the study; and (2) the first report on the law of non-navigational uses of international watercourses. The first document recounts the deliberations of the Commission, and includes a review of issues, literature, precedents, member opinions, and treaties dealing with international waters. The second report discusses issues to be considered by the Commission prior to beginning substantive work. Among these issues: (1) definitions of international watercourse (such as rivers, canals, or lakes making up or crossing an international boundary), and non-navigational uses (pollution, floods, erosion, agricultural, economic, and commercial, cooling, domestic and social); (2) whether the starting point is the boundary concept with opposing sovereignties on either side, or the physical characteristics of water in which regulations of one power over such matters as water level control or pollution directly affect the other; (3) differences between watercourses which form a boundary and those which cross it; and (4) more than two states sharing a watercourse (the entire basin must be viewed as a unified whole). (Lynch-Wisconsin)
W80-00423

TECHNICAL COOPERATION AMONG DEVELOPING COUNTRIES WITH REGARD TO WATER RESOURCES DEVELOPMENT.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 3, p 943-952.

Descriptors: *Water resources development, *International cooperation, *Developing countries, *Technical cooperation, *Scientific personnel, United Nations, River basins, River basin development, Water management(Applied), Technology, Information exchange, Training, Education, Research and development, Planning, Financing, Regional planning, International commissions, International waters, Institutions.

A report to the 1977 United Nations Water Conference by the Ad Hoc Group of Experts on Technical Co-operation among Developing Countries in Water Resources Development focuses on need for: (1) an improved information base; (2) research, education, and training; (3) experts and consultancy services; (4) standardization of services and equipment; (5) planning and management problems; (6) financial aspects; and (7) actions at regional and interregional levels. Recommendations include: (1) inventory resources available in the countries involved, including research, educational, and training facilities, and experts and consulting services at the national, subregional, and regional level; (2) establish institutional arrangements for data exchange; (3) evolve and streamline procedures for offering and receiving cooperation among developing countries in research, education, and training related to water resources development; (4) establish a roster of experts, and provide financial and other incentives to induce them to work in other countries; (5) standardize technical terms and water structures; (6) formulate joint international programs for watershed management, inland navigation, flood forecasting and warning systems, integrated river basin development and management, and groundwater prospecting and development; (7) establish pools of construction plants and equipment; (8) utilize regional development banks and third-party financing; and (9) strengthen the U.N. Regional Commissions to enable them to promote technical cooperation. (Lynch-Wisconsin)
W80-00425

WATER LAW AND LEGISLATION: HOW TO USE THEM TO OBTAIN OPTIMUM RESULTS FROM WATER RESOURCES,
International Association for Water Law.
G. J. Cano.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, part 3, p 993-1016.

Descriptors: *Water law, *Legislation, *Water policy, *Water resources, *Water supply, *Methodology, Legal aspects, Hydrologic cycle, Water rights, Water users, Water utilization, Land tenure, Administration, Regional development, Arid lands, Optimization.

A methodology for using water legislation as a tool for carrying out water policies draws on conclusions and recommendations of two international water law conferences and on a document prepared by the Economic Commission for Asia and the Far East. Subjects discussed: (1) drafting water laws, (2) role of policy-making and legislative authorities and the role of users, (3) content of water laws, (4) the hydrological cycle and water law consolidation, (5) legal codes, (6) legislative methodology, (7) reasons why many water laws impede rather than promote optimum water use, (8) trends in water law modernization, and (9) water legislation as a policy instrument in other areas, such as location and size of communities, regional integration, land distribution and tenure in dry areas, zoning, food production, and environmental policy. Water legislation must deal with four relationships: (1) person-person, (2) person-water, (3) government-person, and (4) within the government. Laws should cover water policy, data gathering, water ownership and control, rights acquisition, restrictions on sources of uses, priorities, use conditions, rights of nonusers, protection against harmful effects of water, judicial aspects, administration, registration and classification of water and uses, and approval of new use techniques. General faults of water law include uncertainty, rigidity, incompleteness, lack of realism, lack of functional coordination, inter-jurisdictional problems, poor administrative coordination, and use- rather than resource-orientation. (Lynch-Wisconsin)
W80-00428

THE DESIGN AND EVALUATION OF INSTITUTIONAL ARRANGEMENTS FOR WATER PLANNING AND MANAGEMENT,
Colorado Univ., Boulder. Dept. of Economics.
C. W. Howe.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 3, p 1063-1104.

Descriptors: *Institutions, *Planning, *Water management(Applied), *Design criteria, *Evaluation, *Administrative agencies, Governments, Institutional constraints, Water policy, Political constraints, Botswana, Israel, Hungary, Indonesia, Iran, Argentina, Soviet Union, East Germany, Pakistan, Tanzania, United Kingdom, Brazil, India, Mexico, France, Spain, Canada, United States.

Institutional structures for water planning and management in 18 countries is analyzed. Factors contributing to effective institutional design and evaluation are identified. Issues determining water planning and management performance include: (1) basic water laws and traditions; (2) organizational structure; (3) arrangements for coordinating water agencies among themselves and with other sectors; (4) arrangements for linking technical water planning and management to political decision-makers at the local and national level through two-way information flows; and (5) arrangements for funding of planning, research, construction, and operations. Organizational structures of the 18 countries are presented in outline form, showing agencies and their responsibilities. Countries are grouped by size and whether organization is centralized, decentralized, or coordinated decentralized. Countries: Botswana, Israel, Hungary, Indonesia, Argentina, Iran, Soviet Union, East Germany, Pakistan, Tanzania, United Kingdom, Brazil, India, Mexico, France, Spain, Canada, and United States. Institutional arrangements taken from these outlines are then summarized in a series of outlines according to the issues listed above, grouped by degree of centralization. Nine criteria are given for evaluating institutional performance; among them are information generation, responsiveness to externalities and priorities, expeditiousnes, economic efficiency, review, initiative, and future planning. (Lynch-Wisconsin)
W80-00431

POLICY AND ORGANIZATION OF WATER RESEARCH IN THE UNITED KINGDOM.
For primary bibliographic entry see Field 6A.
W80-00439

ENVIRONMENTAL ASPECTS OF POLLUTION CONTROL IN HUNGARY,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 6A.
W80-00441

WATER LAW AND ITS APPLICATION IN POLAND,
Ministry of Agriculture, Warsaw (Poland).
S. Surowiec, and A. Deja.
In: Water Management and Development, Proceedings of The United Nations Water Confer-

ence; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1737-1744.

Descriptors: *Poland, *Water law, *Water management(Applied), *Permits, *Regulation, *Water utilization, *Ownership, *Socialism, *Water rights, Legislation, Legal aspects, Water supply, Water resources development, Planning, Administration, Governments, Irrigation, Jurisdiction.

The Polish Water Law of 1974 amplifies the water law of 1962, which replaced that of 1922; the current regulations tie basic legal institutions to the socialist economy based on planned management and control. Because of scarce water resources and rapidly rising demand, the 1974 law stresses water resources development planning. Basic legal concepts cover water ownership and utilization. Flowing waters and groundwater (except wells) are state property, while stagnant and ditch waters and wells are the property of the landowner. Ownership of land under flowing waters belongs to the water owner, whereas ownership of nonflowing water follows land ownership. The water license is the basic legal instrument for controlling water utilization. Disputes regarding compensation connected with water licenses are resolved by administrative authorities which issue the licenses, thus usually eliminating court delays and costs. The administrative authorities also have jurisdiction over disputes involving delimitation of land covered by surface water, embankment cost-sharing, and redistribution of water surplus. The law recognizes three forms of water utilization: (1) public, (2) normal (or private), and (3) specific. Only the third requires a license. The licenses protect both the interests of other parties affected by the utilization, and the national interest. The law also regulates pollution and flood control, reservoirs, and irrigation, and provides for charges for consumption and waste disposal. (Lynch-Wisconsin)
W80-00443

RIVER BASIN MANAGEMENT IN THE UNITED KINGDOM.
Department of the Environment, Reading (England). Central Water Planning Unit.
For primary bibliographic entry see Field 6A.
W80-00449

THE LONG-TERM NATIONAL PROGRAMME FOR RIVER BASIN DEVELOPMENT, BASIS OF THE WATER MANAGEMENT POLICY IN ROMANIA,
For primary bibliographic entry see Field 6A.
W80-00450

FINNISH EXPERIENCES IN WATER-RESOURCES PLANNING AND MANAGEMENT POLICY,
National Water Board of Finland, Helsinki.
For primary bibliographic entry see Field 6A.
W80-00451

EXPERIENCES IN JOINT ADMINISTRATION OF BORDER WATERCOURSES,
For primary bibliographic entry see Field 6A.
W80-00452

SWEDISH POLICY FOR WATER QUALITY PROTECTION,
National Swedish Environment Protection Board, Stockholm.
A. Hanson.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 1965-1979.

Descriptors: *Sweden, *Water policy, *Water pollution control, *Administration, *Financing, *Law enforcement, Legislation, Effluents, Industrial wastes, Municipal wastes, Wastewater treatment, Technology, Water conservation, Permits, Grants, Administrative agencies, Institutions, Water purification, Problem identification and ranking.

Legislative, administrative, technological, and financial aspects of water quality control in Sweden are discussed. A permit system was established in the late 1930s to control effluent discharges, strengthened by the Environment Protection Act of 1969. Permits are now awarded by the National Franchise Board for Environment Protection, a cornerstone of national water conservation policy. An appendix enumerates activities subject to prior assessment. The absence of specifications and standards and promotion of individual assessment has accelerated technological development of protective measures. To control abuses of water-polluting industries in their relationships with municipal wastewater networks, a double assessment procedure was adopted in which measures required of the industry are determined and sanctions are imposed or withheld to ensure compliance. The government controls siting of polluting industries. The primary enforcement authority is the National Environment Protection Board. Centralization of administration has expedited pollution control and resulted in uniformity of operation and policy and in rapid problem identification. Government and industry have cooperated closely in environmental protection, including the joint Institute for Water and Air Pollution Research. Chemical purification is the standard for municipal wastewater treatment, supplemented by filtration in sensitive systems. For industry, processing and structural modifications have been used. Government grants have been a powerful control instrument. (Lynch-Wisconsin)
W80-00454

TOXIC SUBSTANCES IN WATER--THE U.S. EXPERIENCE.
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 5G.
W80-00456

WATER RESOURCES DEVELOPMENT, AND MANAGEMENT PLANNING IN ARID ZONES: CASE HISTORY-ISRAEL,
Tahal Consulting Engineers (Israel).
For primary bibliographic entry see Field 6A.
W80-00457

ESTABLISHMENT OF QUALITY CRITERIA FOR WATER USE IN AUSTRALIA,
Caulfield Inst. of Tech., Victoria (Australia). Water Studies Centre.
B. T. Hart.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 2089-2106.

Descriptors: *Australia, *Water quality criteria, *Water management(Applied), *Water pollution control, *Planning, Water quality standards, Governments, Water policy, Methodology, Water utilization, Environmental effects, Toxicity, Bioassay, Ecosystems, Recreation, Agricultural runoff, Industrial wastes, Pollutants.

In 1970 attention in Australia was focused on water pollution by release of a governmental report, Water Pollution in Australia, and by introduction of environmental legislation in several states. This pointed up the need for quality criteria on which to base assessments of short- and long-term effects of pollutants. To partially meet this need, a Compilation of Australian Water Quality Criteria was commissioned, published in 1974. The present paper deals with: (1) preparation of the criteria document, (2) uses of water quality criteria, (3) development of water quality standards, (4) criteria and environmental planning, (5) use of criteria in developing a water management strategy, and (6) updating criteria. In contrast to standards, which constitute legally enforceable levels and include a water use classification and a plan for implementation and enforcement, a criteria document involves data collection followed by estimation of safe exposure levels relative to uses of a water body. Criteria provide: (1) an assessment of short- and long-term effects of a pollutant at any concentration, (2) scientific information for natural resource use and environmental planning, and (3) necessary data for establishing water quality standards. Examples are given to illustrate these uses, and a methodology is described which was used to develop a water quality strategy for the Albury-Wodonga area. The 1974 document contains criteria related to domestic water supplies, preservation of aquatic ecosystems, agriculture, industry, and recreation. (Lynch-Wisconsin)
W80-00460

INTER-STATE RIVERS IN AUSTRALIA,
Melbourne Univ., Parksville (Australia).
S. D. Clark.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2109-2120.

Descriptors: *Australia, *Murray River(Australia), *Darling River(Australia), *Interstate rivers, *Interstate commissions, *Water rights, Water law, Rivers, Judicial decisions, Legislation, Tributaries, Irrigation, Water supply, Legal aspects, Navigation, New South Wales(Australia), Victoria(Australia), South Australia, Federal government, History, River Murray Waters Agreement, History, Institutions, Administrative agencies, River basin development, Arid lands, River basin commissions.

With reference to current efforts to revise and strengthen Australia's River Murray Waters Agreement of 1914, this paper traces the background of Australian constitutional and legal history, disputes among New South Wales, Victoria, and South Australia over use of the Murray-Darling River system, and provisions of the original agreement. The Murray-Darling system, has generated difficult water disputes and profoundly influenced distribution of power by the federal government and states. Though the river system drains about one-seventh of the country, its average annual flow is very small. Extreme flow variability exacerbates use of Australia's water resources; an extreme example is the Darling, the Murray's longest tributary, which varies from 1230 to 13.5 million cu m/yr. Irrigation in Australia requires more than twice as much storage to even out flow as in the United States. The River Murray Waters Agreement sought to: (1) lay down a mutually agreeable program of locks and storages, (2) apportion financial and building responsibilities, (3) establish navigation tariffs, (4) develop a formula for determining the volume of water each upstream state can withdraw and the amount of compensation water allowed to flow to South Australia, and (5) permit water to be released for saline dilution flows. Administration was vested in the River Murray Commission, composed of representatives of each state and the federal government, but it was given very little independent power. The new government would broaden the Commissions functions but stop short of granting it coercive powers. (Lynch-Wisconsin)
W80-00461

ON ROLE OF ADMINISTRATIVE, ECONOMIC AND TECHNOLOGICAL MEASURES IN PROTECTION OF SURFACE AND SUBTERRANEAN WATER AGAINST CONTAMINATION AND DEPLETION,
All-Union Scientific Research Inst. for Protection of Waters (USSR).
V. R. Lozansky, A. K. Kuzin, and I. D. Pichakhchi.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2179-2194.

Descriptors: *Soviet Union, *Planning, *Water pollution control, *Water resources, *Economics, *Administration, *Technology, Legal aspects, Administrative agencies, Governments, Water policy, Surface waters, Subsurface waters, International cooperation, Watersheds(Basins), Point pollution, Nonpoint pollution, Socialism, Central planning.

The Soviet Union's planned economy controls all activities pertaining to protection of surface and subsurface waters, and integrates material, labor,

and monetary resources for control efforts. Programs can be geared to basins or branch of industry. Central planning ensures proportional development of technological, administrative, economic, and legal measures. Technological measures include: (1) transition to waterless methods of production, (2) development of efficient and economically feasible treatment methods for effluents and urban and agricultural surface runoff, and (3) automation of water protection. The most important administrative measure was creation of a national water management agency, responsible for monitoring implementation of water protective measures, discharge of effluents, and treatment plant operations. The agency is organizing and overseeing a national planning program. Economic measures involve: (1) preferential credit terms for water protection plans, (2) introduction of payments for water usage and effluent discharge, and (3) fines for pollution. National and international legal documents can contribute significantly to water protection. For water bodies shared by several countries, international commissions could assist in solving general problems of water protection and allot water usage on the basis of optimization modelling and international law. (Lynch-Wisconsin)
W80-00465

EXAMPLES OF THE ORGANIZATION OF SELF-ADMINISTRATION IN THE WATER ECONOMY OF THE FEDERAL REPUBLIC OF GERMANY,
Ruhrtalsperrenverein, Essen (Germany, F.R.).
F. Bergmann.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata,Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2267-2274.

Descriptors: *Ruhr District(West Germany), *Water management(Applied), *Sewage treatment, *Water supply, *Ruhr Valley Association(West Germany), *Ruhr Authority(West Germany), *Administrative agencies, River basins, River basin commissions, Sewage disposal, Waste water treatment, Industrial wastes, Municipal wastes, Institutions, West Germany, Water pollution control, Financing, Regional planning, Regional development.

The Ruhr Valley Association is responsible for water supply and the Ruhr Authority for water quality (especially sewage treatment) in West Germany's heavily industrialized and densely populated Ruhr District. Both are good institutional examples of industrial and public cooperation in long-term regional water management. They were created in 1913 by public law with self-administration, but subject to government supervision. Associate members of the authority are all entities polluting the Ruhr Basin, including local authorities, industrial and business enterprises, and water consumers belonging to the valley association. Members of the latter are owners of water works and other facilities which remove over 30,000 cu m of water from the basin annually. Organization of the two agencies is similar. General meetings of members and boards elect board members and pass judgment on budget plans and assessment principles. Number of votes per member depends upon contribution. The same person usually is chairman in both groups. Construction, maintenance, and operation costs are covered by member contributions, assessed according to members' benefits and costs. Between 1948-75 the Association spent 660 million DM on reservoirs and the Authority 380 million DM for building expenses. Fourteen reservoirs store water for dry periods, which is supplied to the rivers to increase flow rate and improve water quality. (Lynch-Wisconsin)
W80-00470

ISRAEL- A MODEL OF EFFICIENT UTILIZATION OF A COUNTRY'S WATER RESOURCES,
Ministry of Agriculture, Tel-Aviv (Israel).
S. Arlosoroff.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, part 4, p 2283-2334.

Descriptors: *Israel, *Water resources development, *Arid lands, *Water conservation, *Water supply development, *Water management(Applied), Water utilization, Legal aspects, Administration, Agriculture, Irrigation, Industrial water, Economic development, Financing, Water shortage, Legislation, Groundwater, Saline water intrusion, Water policy.

Carefully managed scarce water resources in Israel since 1948 has enabled successful development of agriculture and industry in an arid region and has permitted unusually high population growth. Israel's experience demonstrates necessity for full use and coordination of legislation, administration, research and technological innovation, instruction, and extension services. This paper covers: (1) background on geography, climate, water resources, water policy, special constraints, and nonconventional water sources; (2) legislation and administration; (3) and efficient water use in agriculture, the domestic sector, and industry. Total usable water resources amount to about 1700 million cu m/yr, only slightly greater than current requirements. Groundwater and springs account for 60% of total water, surface water 25% (mainly in the Jordan watershed), and flash floods 5%. Extensive coastal groundwater supplies must be withdrawn sparingly to prevent seawater intrusion. Large-scale desalination has been postponed to await economic and technological justification. Principal water resources are located in the extreme northeast, while demand is concentrated in the center and south. To best use the limited water, government policy encourages reuse of effluent in agriculture and industry; water pollution control consequently is a major concern. The national water carrier, completed in 1964, conveys about 350 million cu m/yr from the Lake Kinneret southward by pipes, canals, and tunnels. Appendices present: (1) field testing of irrigation fittings. (2) water saving fittings, and (2) industrial financing of water saving projects. (Lynch-Wisconsin)
W80-00471

RIVER BASIN PLANNING IN CANADA,
Department of the Environment, Ottawa (Ontario). Water Planning and Management Branch.
For primary bibliographic entry see Field 6A.
W80-00472

U.S. INLAND WATERWAY TRANSPORTATION,
Department of Transportation, Washington, DC.
J. L. Craig, and L. Y. Wald.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2371-2384.

Descriptors: *United States, *Inland waterways, *Transportation, *Rivers, *Canals, *Water management(Applied), *Navigable waters, Intracoastal waterways, Channel improvement, Governments, Local governments, Federal governments, State governments, Environmental effects, Administrative agencies, Institutions, Water resources development, Shipping, Navigation.

The inland waterways transportation system in the United States, considered 95% complete, was largely developed by the federal government, which builds, operates, maintains, and modernizes channels, locks, and dams. State and local governments, special authorities, and private interests have provided port and terminal facilities, land easements, and right of way, and private industry has contributed engineering innovations. The Federal Government spent about $4.6 billion through 1974 on construction, maintenance, and operation. Only limited further development of new waterways or river canals is anticipated due to rising costs, declining potential economic benefits, environmental considerations, and changing national priorities. The continental U.S. has 41,124 km of navigable inland and intracoastal channels, exclusive of the Great Lakes. The Mississippi River and Gulf Intracoastal Waterway systems account for 58% of the total mileage and 73% of prime channels with depths of 2.7-4.2 m. Of total U.S. intercity freight traffic, inland waterway transportation in 1974 was 9.5% of tonnage and 10.1% of ton-miles. Petroleum and coal account for 53% of the total waterborne tonnage of 1.7 billion tons/yr. Four federal agencies play important roles in inland waterways operation, the U.S. Army Corps, Interstate Commerce Commission, U.S. Coast Guard, and Maritime Administration. Environmental problems related to inland waterways include fuel consumption, disposal of dredged materials, and pollution by sewage and hazardous substances. (Lynch-Wisconsin)
W80-00473

THE INDUSTRIAL WATER SERVICE OF JAPAN,
Ministry of International Trade and Industry, Tokyo (Japan).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, part 4, p 2439-2450.

Descriptors: *Japan, *Industrial Water Service(Japan), *Industrial water, *Water supply development, Water management(Applied), Groundwater, Administrative agencies, Institutions, Water demand, Local governments, National governments, Water rates, Financing, Costs, Subsidies.

Without it's Industrial Water Service, Japan could not have achieved its current level of local development and industrial/economic growth; construction has been in progress for 20 years, funded in part by a subsidy system established in 1956. By April 1976 170 projects had been completed, with water supply capacity of 19 million cu m/day. Another 76 projects are under construction, having capacity of 10 million cu m/day. The system has provided new sources of water supply to replace unreliable groundwater supplies. In recent years the service has met more than half the increment in industrial water demand. A total of 829 billion yen have been spent on the system, 206 billion from subsidies. The remainder has come from government securities and loan corporation bonds and from private corporate bonds. Although original plans envisioned participation of private organizations in system construction and management, the majority of the projects were undertaken by local governments and are run as local public services. Of the 90 Industrial Water Services, 83% are run by prefectural governments. Rates are set according to the financial requirements of management. Of the 230 million cu m/day water demand predicted for 1985, 78 million cu m/day will be supplied by the service, an increase of 30 million cu m/day over 1970. Whereas construction has been concentrated in littoral industries, inland businesses will receive more attention. (Lynch-Wisconsin)
W80-00476

COASTAL ZONE MANAGEMENT IN THE UNITED STATES,
National Oceanic and Atmospheric Administration, Washington, DC. Office of Coastal Zone Management.
R. R. Gardner.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, part 4, p 2483-2489.

Descriptors: *United States, *Coastal Zone Management Program, *Water management(Applied), *Coasts, *Comprehensive planning, *State governments, *Regulation, Federal governments, Ecology, Planning, Ecosystems, Urbanization, Industrialization, Land use, Permits, Zoning, Administrative agencies, Institutions, Legislation, Environmental effects, Water pollution control, Air pollution.

The U.S. Coastal Zone Management Program was created in 1972 in response to intense urban and industrial development of coastal regions. Unlike other resource protection programs, it adopts a comprehensive approach regulating all coastal activities to solve such individual problems as water pollution and wetland destruction. Rather than focusing on wateror air, the program deals instead

with the nature and location of development itself. Jurisdiction includes the land area, coastal waters, bays, and estuaries. An effort is made to return land-use control from local authorities to state governments, restricting the federal role to promoting coastal management through financial assistance contingent on compliance with federal guidelines. A unique provision is that once a state coastal program has been approved, all subsequent federal actions must be consistent with that program. The state programs generally aim to balance development and preservation requirements. Three phases are involved: (1) preparation (data collection, identification of appropriate authorities, boundaries establishment, preparation of a program document, and federal approval); (2) implementation (enabling legislation, governmental reorganization, etc.); and (3) operation. Up to 80% federal funding is provided for all phases. As of 1976 Washington had an approved program in operation, and most of the other 33 states and territories were in the second or third year of preparation. (Lynch-Wisconsin)
W80-00478

BOUNDARY WATERS MANAGEMENT,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
R. L. Pentland, and B. L. Long.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2525-2538.

Descriptors: *Treaties, *International Joint Commission, *United States, *Canada, *International waters, *Water management(Applied), *Great Lakes, *St. Lawrence Basin, International cooperation, Boundary waters, Lakes, River basins, Institutions, Navigation, Water Pollution control, Political aspects, Water rights, Jurisdiction, Water levels, Boundary Waters Treaty of 1909, International law.

The successful boundary water agreements between the United States and Canada are based on two premises: (1) one country may not undertake water-related activities at the expense of the other, and (2) international water problems must be resolved cooperatively and in accordance with agreed principles, such as those embodies in the Boundary Waters Treaty of 1909. The International Joint Commission, established by the treaty, has achieved consensus in over 95% of issues submitted to it, and a provision for binding arbitration has never been used. A major strength of the IJC has been its direct access to technical assistance from departments and agencies of both governments, access which has been notably nonpolitical. A recent trend is toward more public operation of the IJC, with reduced confidentiality of reports and information. Some 3900 of the 8900 km of the U.S.-Canadian border lie along or across water bodies, including the Great Lakes-St. Lawrence Basin. The IJC is empowered to investigate and report upon matters of difference referred to it by either or both governments and to make nonbinding recommendations. IJC approval is required for any use, obstruction, or diversion of boundary waters in one country affecting the natural level or flow in the other. Procedures are described. The treaty guarantees free and open navigation on all boundary waters to both countries and on canals in one country but connecting boundary waters tolls must be the same for both countries. Use and control rights are specified, and pollution is regulated. (Lynch-Wisconsin)
W80-00480

IRRIGATION MANAGEMENT IN DEVELOPING COUNTRIES: A SUGGESTED ACTION PROGRAMME,
Overseas Development Inst., London (England).
For primary bibliographic entry see Field 3F.
W80-00481

POLLUTION CONTROL IN THE MINING INDUSTRY IN SOUTH AFRICA,
For primary bibliographic entry see Field 5G.
W80-00484

WATER USA: 1776-1976,
Colorado State Univ., Fort Collins. Dept. of Political Sciences.
H. P. Caulfield, G. D. Cobb, T. Schad, and H. A. Steele.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978. Pergamon Press. Vol 1, Part 4, p 2617-2639.

Descriptors: *United States, *History, *Water resources development, *Water management(applied), *Planning, *Legislation, Political aspects, Water conservation, Environmental effects, Water pollution control, Flood control, Navigation, Water utilization, Economic development, River basins, Watershed management, Water policy, Evluation, Groudwater, Surfacewaters, Industrial water, Recreation, Institutions, Administrative agencies.

The relationship between water management in the United States and national goql and objectives is analyzed from a historical perspective, 1776-1976. Contents: (1) Early growth of the nation. (2) Origins of a national water policy in the 19th and early 20th centuries, with a discussion of the beginning of the conservation movement. (3) The era of major water resource development, 1933-1945. (4) The environmental movement beginning in the Institutional arrangements for improved water management, including the Water Resources Planning Act of 1965, the Water Resources Council, federal agencies responsible for water resources management, and river basin organizations. (6) National water resources planning. (7) Role of water in future national development (population and economic growth, domestic use, mining and energy production, manufacturing, food and fiber production, recreation, navigation, water quality, water use). (8) Evaluation of the U.S. experience. A major deficiency has been a failure to adequately relate water quality questions to other aspects of water resources management, resulting in the current major investments to restore water quality. Protection of ecological systems was also neglected, and there was a failure to plan for, and to provide institutional arrangements, for integrated management of ground and surface waters, and for flood plain management. Accomplishments have included safe drinking water, major water development programs, intergovernmental cooperation, integrated and comprehensive management, and management of international waters. (Lynch-Wisconsin)
W80-00486

FEDERAL TAX INCENTIVES FOR PRIVATE ENVIRONMENTAL PLANNING,
Hill and Barlow, Boston, MA.
K. Browne.
Natural Resources Lawyer, Vol. 10, No. 4, p 753-759, 1978.

Descriptors: *Regressive taxes, *Land use, *Indirect benefit, *Tax incentives, *Easements, *Estate taxes, Taxes, Land appraisals, Evaluation, Economic justification, Open space preservation, Planning, Legal aspects, Land tenure, Public access, Economics, Competing uses, Assessments, Eminent domain.

Indirect subsidies through charitable tax deductions are not fully appreciated by private landowners and may not last long in their present form, because federal support for private open space protection through tax deductions are not likely to be continued indefinitely without conditioning such support on compliance with sound land use regulations. A hypothetical problem is given to illustrate use of federal tax incentives to preserve open space. The problem involves an island occupied by one family just off a heavily populated coastline, the value of which has heavily increased. Death taxes will consume most of the family liquid assets leaving the surviving widow and children land-poor and short of needed income. Three kinds of remedies are suggested, all of which may in many cases relieve the widow of part of the death tax burden and additionally help satisfy local objectives for open-space land use controls: (1) a conservation restriction or easement, which severs development rights inherent in the land; (2) a charitable remainder gift, in which the widow retains right to the property during her lifetime with possession passing onto a charity or subdivision after her death; (3) the bootstrap technique, which involves sale of a portion of the land in order to maintain the rest in open space for family use. (Harris-Wisconsin)
W80-00496

IMPLEMENTATION STRATEGIES FOR PUBLIC LAW 92-500, SECTION 208,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
S. D. Sidrane.
Discussions in Environmental Health Planning, October 1978. 114 p, 9 fig, 78 ref.

Descriptors: *Water quality control, *Water quality management(Applied), *Federal Water Pollution Control Act, *208 water quality planning, *Water resources planning, *Water pollution control, Models, Water quality, Institutions, Funding, Public participation, Social aspects, Political aspects, Administration, Local governments, Regions.

The author analyzes, describes and relates the current effectiveness of the Federal 208 Water Quality Planning Program. This program is not seen as achieving its desired objectives due to a lack of integration between water quality management programs and political agendas, and due to a lack of government ability to maintain an active public constituency concerned with continuing the program. Four institutional water quality management models are examined to test this hypothesis. The areawide model is found to enable planners to communicate closely with a constituency, but within a limited jurisdiction; the basinwide model considers water quality under one geographical unit, but frequently the authority is removed from its constituency; the regional-state management model has similar problems to the basinwide agency model, although it has more authority to carry out its management program; the congressional-federal agency model usually has the best access to information and has a strong source of authority, but is farthest removed from a potential supporting constituency at the local level. The author concludes that the 208 planning program can only succeed through full acceptance by local governments, creation of a continuing planning agency process to continue the program, redefining 208 priorities, and a review of individual management work plans and the need for further research. (Arnold-NC)
W80-00524

INTEGRATION OF RESIDUAL WASTE MANAGEMENT WITH WATER QUALITY MANAGEMENT,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
E. M. Dollard.
Discussions in Environmental Health Planning, January 1979. 204 p, 5 fig, 2 tab, 131 ref.

Descriptors: *Water quality, *Water quality management, *Water management(Administrative), *Water pollution, *Wastewater management, *Federal Water Pollution Control Act, *Residuals, *Residual waste management, Planning, Water reuse, Sewage treatment, Sludge, Wastewater treatment, Sewage effluents, New York, Massachusetts.

This study assumes the interrelationship of water quality management, defined as management of water for its suitability for certain purposes, and residual waste management, or management of those substances remaining after completion of various human processes such as agriculture and manufacturing. Water quality and residual wastes are seen as related concerns, and should not be dealt with by separate administrative organizations. As an example, as larger wastewater treatment plants are built, they will, while improving water quality, nevertheless generate more sludge. Reuse and land application are two suggested methods for using this increased sludge load. An

historical perspective reveals that while authority to control water pollution has shifted to the federal government, residuals management has remained largely a state perogative. A regional approach, using federal and state grant mechanisms, is proposed for integrating the control of water quality and residuals management under one administrative unit. Two regional planning areas, one in New York and one in Massachusetts, have adopted such an integrative strategy. A five step process for such program integration at the regional level includes identification of problems common to both management functions, collection of data relating one function to the other, inclusiong of the public and private industry in the planning process, design of programs which consider water quality-residual waste interrelationships, and implementation and evaluation of water quality-residual waste program. (Arnold-NC)
W80-00526

INTEGRATED PLANNING AND WATER QUALITY MANAGEMENT: THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972 AND COASTAL ZONE MANAGEMENT,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
W. K. Allayaud.
Discussions in Environmental Health Planning, January 1979. 217 p, 2 fig, 5 tab, 56 ref.

Descriptors: *Water quality, *Water quality management(Applied), *208 planning, *Coastal zone management, *Federal Water Pollution Control Act, *Environmental regulation, *New York, *Long Island(NY), *Water pollution control, Planning, Land use, Land use controls, Sewage disposal, Institutions, Governments, Potable water, Legislation.

This report relates water quality management planning issues to coastal zone management issues. The 208 planning process and coastal zone management must be integrated, which causes both legal and institutional problems. The author examines the problems of integrating the planning processes vis-a-vis five issues: integration of land and water planning; the role of local, state and federal government; coordination and integration of planning processes; sewage disposal in the coastal zone; and the 208 plan. The need for integration of land and water planning is clear but many limiting obstacles and conflicts exist. However, integration can be achieved to various degrees, with state government being the logical center to accomplish this. Recommendations include: states should play a lead role in integration of land and water planning, with supportive national policy and federal funds and assistance through national programs that encourage integration; states should assume a stronger role in policy decisions and plan implementation under both PL 92-500 and CZMA; integration of water quality planning processes is essential; decisions on ocean disposal of sewage should be postponed, allowing for continued planning to clarify the situation. A number of key recommendations are made concerning the 208 planning process and resulting 208 plans, including strong land use concerning the 208 planning process and resulting 208 plans, including strong land use control, 208 plans that can be integrated with coastal zone management plans, establishment of criteria for plan approval, and consideration of whether the plan can be implemented. Two case studies are presented to show the issues involved in integrating 208 planning with coastal zone management--New York State and Long Island, NY. (Cooper-NC)
W80-00527

INSTREAM FLOW STRATEGIES FOR WASHINGTON,
Enviro Control, Inc., Fort Collins, CO.
W. Nelson, G. Horak, and S. Wilsey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 046, Price codes: A05 in paper copy, A01 in microfiche. Fish and Wildlife Service, Biological Services Program FWS/OBS-78/46. May 1978. 107 p, 10 tab, 155 ref. 14-16-0008-2121.

Descriptors: *Water resources, *Washington, *Streamflow, *Fish and wildlife, *Aquatic habitat, *Water law, *Reservoirs, *Evaluation matrix, *Information matrix, *Reservoir storage, *Planning, Navigable waters, Engineering alternatives, Reservoir construction, Matrices, Stream channels, Water rights, Dams, Sediment release, Water permits.

This study identifies, describes and evaluates strategies and institutional methods for reserving instream flows for fish and wildlife in the State of Washington. Five strategies--appropriative water rights, legislative and administrative controls, water resource planning, water resource management, and engineering alternatives--are presented in an information matrix to help decision makers select strategies most applicable to any given situation. A general description of the strategy is presented, along with the most applicable situations for its use, a list of parties who can initiate the strategy and the parties who must implement it. An evaluation matrix is then presented which provides a subjective analysis of whether each of the five strategies has been used to advantage or disadvantage in Washington or whether it is not applicable in this state. Each strategy is described in detail in the narrative section of the report, including its application possibilities, the use of the strategy in the state, and an evaluation of its general utility. General findings indicate that there are numerous ways in which appropriative water rights under state law may be used to preserve instream flows; existing administrative and legal controls allow for preservation policies to emerge; water resource planning under federal programs and water resource management options for instream flow maintenance are numerous and can be effective; and engineering alternatives have been used and can be effective for reserving instream flows. (Arnold-NC)
W80-00531

INSTREAM FLOW STRATEGIES FOR CALIFORNIA,
Enviro Control, Inc., Fort Collins, Co.
W. Nelson, G. Horak, and M. Lewis.
Fish and Wildlife Service Biological Services Program, FWS/OBS-78/36, May 1978. 96 p, 9 tab, 138 ref.

Descriptors: *Water resources, *California, *Streamflow, *Fish and wildlife, *Aquatic habitat, *Water law, *Reservoirs, *Evaluation matrix, *Information matrix, *Reservoir storage, *Planning, Navigable waters, Engineering alternatives, Federal Water Resource Council, Reservoir construction, Matrices, Stream channels, Dams, Sediment release, Water purity.

This study identifies, describes and evaluates strategies and institutional methods of reserving instream flows for fish and wildlife in California. Five strategies--appropriative water rights, legislative and administrative controls, water resource planning, water resource management, and engineering alternatives--are presented in an information matrix to help decision makers select strategies most applicable to any given situation. A general description of the strategy is presented, along with the most applicable situations for its use, a list of parties who can initiate the strategy and the parties who must implement it. An evaluation matrix is then presented; it provides a subjective analysis of whether each of the five strategies has been used to advantage or disadvantage in California, or whether it is not applicable to the state. Each strategy is described in detail in the narrative section of the report, including its application possibilities, the use of the strategy in the state, and an evaluation of its general utility. The major findings are that there is a lack of state appropriative water rights laws to preserve instream flow; existing legislative and administrative controls are being applied in the state and are effective tools; water resource planning under three federal programs has not been implemented in California but could be utilized to advantage; water resource management programs have had some success in the state, but some programs have no utility; and that existing engineering alternatives do allow for continuance of existing instream flows necessary for fish and wildlife habitat. (Arnold-NC)
W80-00532

WATER RESOURCES. AND THE NATION'S WATER SUPPLY: ISSUES AND CONCERNS,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6B.
W80-00542

COLORADO RIVER BASIN WATER PROBLEMS: HOW TO REDUCE THEIR IMPACT,
Comptroller General of the United States, Washington, DC.
Report No. CED-79-11, May 4, 1979. 137 p, 15 append.

Descriptors: *Colorado River Basin, *Water resources management, *Water supply, *Regional development, *Water policy, *Water resources, *Water utilization, *Water resources planning, River basin commissions, Water quantity, Irrigation water, Water demand, Water law, Social aspects, State governments.

This report analyzes major management problems with the Colorado River system, which drains 242,000 square miles in seven Western states. The primary concern is that unless the appropriate local, State and Federal agencies develop effective inter-cooperation, this seven state area will not be able to cope with a probable water shortage soon after the year 2000. Current water supply is insufficient to meet future demands and the current salinity control program may not be cost effective in achieving desired results. New methods of managing the Basin's water resources are needed. The average annual flow of the river dropped 18% between 1903 and 1977. Salinity levels have increased due to a rise in usage through diversion of upstream water. New methods for managing the basin's resources include more local-Federal agency conflict resolution and consideration of all water resources in the basin as a total system. The GAO recommends forming a politically sensitive Basin Task Force to delineate and propose solutions to the issues outlined in this study. Appendices include identification of selected legislation and compacts affecting operations of the Colorado River, availability and use of groundwater, salinity control projects, efforts to conserve and augment water supply, and Indian water rights claims. (Arnold-NC)
W80-00545

WAYS TO RESOLVE CRITICAL WATER RESOURCES ISSUES FACING THE NATION,
Comptroller General of the United States, Washington, DC.
Report No. CED-79-87. April 27, 1979. 44 p, 17 ref. 2 append.

Descriptors: *Water resources planning, *Cost/benefit analysis, *Water policy, *Water law, *Water resources development, Social aspects, Costs, Water supply, Water management, Water users, Conservation, Water consumption, Groundwater.

This report outlines critical water resource problems in the United States and how these problems may be resolved. Noting that the President's May 23, 1977 Environmental Message called for a vast overhaul of Federal Water Policy, this report examines water issues in light of that message. Steps such as combining the authorization and funding stages of a project to quicken project approval are recommended. Also proposed is the use of flexible authorization ceilings to allow for inflation and avoid delay in project approval and construction. Strengthening the role of either the Office of Management and Budget (OMB) or the Water Resources Council (WRC) could make project cost/benefit analyses more reliable. Serious groundwater problems can only be answered once overall policy questions relating to proper level of management are addressed. Urban areas face serious water shortages due to overuse of existing capacity and declining streamflows in some places; water conservation programs are advocated as the primary solution to this problem. The report recommends that Congress should reevaluate the 160

acre limitation on land eligible to receive water from Federal projects. Policy options for increasing State and local control and responsibility for water resources are discussed. Lack of a comprehensive national water policy and priorities and lack of reliable data for decision making would affect the potential success of these options. (Arnold-NC)
W80-00546

GUIDELINES FOR URBAN DEVELOPMENT IN LOUISIANA'S COASTAL WETLANDS,
New Orleans Univ., LA. Urban Studies Inst.
For primary bibliographic entry see Field 4C.
W80-00547

APPROPRIATIVE WATER RIGHTS AND EFFICIENT ALLOCATION OF RESOURCES,
New Mexico Univ., Albuquerque.
H. S. Burness, and J. P. Quirk.
American Economic Review, Vol. 69, No. 1, p 25-37. March 1979, 9 ref. 2 append, EX-76-G-03-1305.

Descriptors: *Water resources development, *Prior appropriation, *Appropriation, *Mathematical models, *Appropriative rights, *Water rights, *Water allocation, Water supply, Water utilization, Water transfer, Riparian rights, Relative rights, Appropriative doctrines, Diversion capacity, Water use, Economic efficiency, Surface water.

The authors propose a model for an efficient allocation of water rights among users under a variation of the appropriative doctrine commonly in practice in the Western United States. Because the present appropriative doctrine favors senior users, users on a 'first come-first served' basis, junior industrial users--important elements of a local economy--may not be able to be allocated their water resources efficiently, leading to suboptimal investment of capital and diversion capacity. Eight propositions, supported by mathematical explanations, are made to illustrate the inequities of the present appropriative system. These propositions indicate that senior water users are in a preferred position, that the addition of each user firm on a waterway renders the allocation system more inefficient if the marginal cost of adding diversion capacity increases, and that in the long run equal sharing of water rights by small users with similar profit functions leads to a more efficient distribution under the appropriative system. Senior users tend to establish an advantage over junior users by locating so as to best use streamflow for their needs, and thus junior users may be at a double disadvantage even though their needs may be legitimately equal to or greater than those of their seniors. Water rights transfer is an important legal mechanism for meeting this problem. (Arnold-NC)
W80-00548

SUMMARY: SOCIAL, ECONOMIC, AND INSTITUTIONAL ASPECTS OF WILDLIFE ENHANCEMENT IN IRRIGATED AGRICULTURE: A STUDY OF THE COLUMBIA BASIN IRRIGATION PROJECT,
Washington State Water Research Center, Pullman.
For primary bibliographic entry see Field 6G.
W80-00633

SOCIAL, ECONOMIC, AND INSTITUTIONAL ASPECTS OF WILDLIFE ENHANCEMENT IN IRRIGATED AGRICULTURE: A STUDY OF THE COLUMBIA BASIN IRRIGATION PROJECT,
Washington State Water Research Center, Pullman.
For primary bibliographic entry see Field 6G.
W80-00634

6F. Nonstructural Alternatives

THE UNITED STATES EXPERIENCE IN FLOOD PLAIN MANAGEMENT,
Department of Housing and Urban Development, Washington, DC.
N. Lally, G. R. Phippen, and F. H. Thomas.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 2071-2086.

Descriptors: *United States, *Flood plains, *Flood control, *Management, *Planning, *Policy, *Nonstructural alternatives, Flood forecasting, Reservoirs, Occupancy adjustments, Flood adjustments, Dams, Dikes, Flood protection, Channel improvement, Incentives, Federal government, Local governments, State governments, Civil engineering, Diversion structures, Water management(Applied).

In the United States, where annual flood damages amount to $2-3 billion, flood plain management initially relied upon high-capital-intensive flood control adjustments at the federal level, leaving low-capital-intensive occupancy adjustments to be applied at the state and local levels. But in the last decade a mix of the two strategies has been adopted in a unified federal state, and local approach. The Federal Flood Control Act of 1936 first made flood control a national policy. The two basic management strategies involve: (1) actions to minimize susceptibility of areas and individuals to flood damage and to minimize damage itself (occupancy adjustments), and (2) actions to modify flood behavior (flood adjustments). Occupancy adjustments include management of flood plain land use and structures, flood forecasting and warning systems, and flood disaster planning and assistance. The more extreme flood adjustment measures, usually costly and environmentally disruptive, include dams and reservoirs, dikes, levees, floodwalls, channel alterations, high flow diversions and spillways, land treatment to decrease runoff (usually in rural areas), an on-site storage of urban runoff waters. Successful flood plain management involves four basic principles: (1) flood plains must be considered in terms of total community, regional, and national planning and management; (2) flood lose reduction is related to economic efficiency, environmental quality, health, and safety; (3) management decisions can be partitioned between national and local levels; and (4) sound management incorporates goals, needs, strategies, accounting, and incentives. (Lynch-Wisconsin)
W80-00459

ON ROLE OF ADMINISTRATIVE, ECONOMIC AND TECHNOLOGICAL MEASURES IN PROTECTION OF SURFACE AND SUBTERRANEAN WATER AGAINST CONTAMINATION AND DEPLETION,
All-Union Scientific Research Inst. for Protection of Waters (USSR).
For primary bibliographic entry see Field 6E.
W80-00465

ON WATER REUSE PROMOTION MEASURES,
Ministry of International Trade and Industry, Tokyo (Japan).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, part 4, p 2453-2462.

Descriptors: *Water reuse, *Japan, *Desalination, *Industrial wastes, *Wastewater treatment, *Municipal wastes, *Subsidence, Water purification, Recycling, Water shortage, Water supply development, Water sources, Industrial water, Municipal water, Reverse osmosis, Multi-flush method, Methodology, Sewage treatment, Denitrification, Biological treatment, Activated charcoal, Water Reuse Promotion Center(Japan).

To meet a predicted Japanese water shortage of four billion cu m/yr by 1985, water reuse programs are being developed as a substitute for conventional surface water and ground-water sources. Water supply is increasingly limited due to ground subsidence which restricts groundwater pumping and factors inhibiting further reservoir development. The national Water Reuse Promotion Center, established in 1973, is concentrating primarily on: (1) city drainwater reuse, (2) industrial water recycling, and (3) desalination of seawater. Although treated municipal water was used in industry as early as 1951, quality of the recycled water is acceptable for only a few specific uses. Further expansion requires advanced treatment. Current experimental projects involve: (1) a demonstration plant for sewage reuse using activated charcoal absorption, (2) a gravity activated charcoal facility, (3) biological denitrification, and (4) powdered activated charcoal. Industrial wastewater recycling has been largely limited to cooling and air-conditioning water; experiments to reuse wastewater from manufacturing and washing processes deal with: (1) petrochemical combinate wastewater, (2) pulp and paper factory wastewater. (3) iron and steel wastewater, and (4) dyeing and weaving plant wastewater. Desalination methods under development include multiflush and reverse osmosis. A prototype multiflush plant being planned will have a capacity of 100,000 cu m/day. (Lynch-Wisconsin)
W80-00477

COASTAL ZONE MANAGEMENT IN THE UNITED STATES,
National Oceanic and Atmospheric Administration, Washington, DC. Office of Coastal Zone Management.
For primary bibliographic entry see Field 6E.
W80-00478

6G. Ecologic Impact Of Water Development

NOTE TO THE UNITED NATIONS WATER CONFERENCE ON PREPARATIONS FOR THE UNITED NATIONS CONFERENCE ON DESERTIFICATION.
For primary bibliographic entry see Field 2A.
W80-00422

WORLD WATER BALANCE AND WATER RESOURCES OF THE EARTH,
National Committee for the International Hydrological Programme (USSR).
For primary bibliographic entry see Field 2A.
W80-00466

FLORAL AND FAUNAL CHANGES IN LOWLAND HARDWOOD FORESTS IN MISSOURI RESULTING FROM CHANNELIZATION, DRAINAGE, AND IMPOUNDMENT,
Missouri Univ.-Columbia, Puxico. Gaylord Memorial Lab.
L. H. Frederickson.
Fish and Wildlife Service, Biological Services Program FWS/OBS-78/91, January 1979. 130 p, 7 fig, 20 tab, 3 append, 38 ref. 14-16-6008-1195.

Descriptors: *Forests, *Water resources development, *Channelization, *Drainage, *Impoundment, *Riparian habitat, *Mingo Swamp(MO), *Missouri River Basin, *Wildlife habitat, Water resource planning, Fish and wildlife, Aquatic habitats, Drainage effects, Plant communities, Hardwood forests, Wildlife management, Wildlife, Marsh management.

This study was designed to gather data on the effects of decreasing forest cover in the lower Mississippi Valley. The objectives were to identify the effects of channelization, impoundments, and drainage on plant and animal communities, and to develop reliable techniques to monitor and predict changes in these communities as a result of such actions. The Mingo Swamp, along a portion of the St. Francis River in Southeastern Missouri, was the study area. Photo interpretation provided overall information on the nature of tree cover with line transects gathered; data on species composition and density were gathered along line transects selected randomly along the river. Among the conclusions reached were that stream channelization reduced or changed riparian habitat, decreasing forest area by as much as 78% as compared to no more than 7% in unchannelized areas; sites inundated the longest had plants most tolerant to flooding; bird populations tended to avoid channel-

ized streams; and that channelization does reduce flooding and benefit agriculture. Recommendations made indicated that other developmental alternatives, such as construction of levees and government purchase of land to protect riparian habitat, are preferred over the adverse effects of channelization, and farmers should be made aware of the changes effected on forest composition from the drainage of their land. (Arnold-NC)
W80-00528

INSTREAM FLOW STRATEGIES FOR WASHINGTON,
Enviro Control, Inc., Fort Collins, CO.
For primary bibliographic entry see Field 6E.
W80-00531

INSTREAM FLOW STRATEGIES FOR CALIFORNIA,
Enviro Control, Inc., Fort Collins, Co.
For primary bibliographic entry see Field 6E.
W80-00532

IMPACT ASSESSMENT OF WATER RESOURCE DEVELOPMENT ACTIVITIES: A DUAL MATRIX APPROACH,
Fish and Wildlife Service, Kearneyville, WV. Water Resources Analysis.
For primary bibliographic entry see Field 6B.
W80-00550

SUMMARY: SOCIAL, ECONOMIC, AND INSTITUTIONAL ASPECTS OF WILDLIFE ENHANCEMENT IN IRRIGATED AGRICULTURE: A STUDY OF THE COLUMBIA BASIN IRRIGATION PROJECT,
Washington State Water Research Center, Pullman.
B. F. Wolfley, S. C. Matulich, R. D. Davies, R. L. Shew, and G. H. Bagwell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-105265, Price codes: A04 in paper copy, A01 in microfiche. Report No. 30, September 1979. 68 p, 2 tab, 36 ref. OWRT-C-7165 (No. 6213) (7), 14-34-0001-6213.

Descriptors: *Wildlife conservation, *Irrigated agriculture, Columbia basin, Fish and wildlife, *Social impacts, Institutional aspects, Economic aspects.

Declining wildlife populations have raised numerous questions concerning the future of public/private fish and wildlife and agricultural benefits created by irrigation development projects. Interrelationships of wildlife and irrigated agriculture were analyzed in terms of social impacts, economic tradeoffs, and institutional ramifications. A secondary purpose of this study was to establish tradeoffs among resources committed to agriculture and/or wildlife production. The study was interdisciplinary in nature and involved analyses from social, economic, and political/institutional disciplines. The analytical framework was designed to provide evaluation of the socioeconomic interaction of recreationists and landowners involved in the production and use of wildlife in irrigated agriculture, and to suggest possible means whereby a satisfactory combination of wildlife and agricultural production may be achieved. The institutional ramifications of incorporating irrigation development with wildlife enhancement are presented, and alternatives to assure long-term fish and wildlife benefits are identified. (See also W80-00634)
W80-00633

SOCIAL, ECONOMIC, AND INSTITUTIONAL ASPECTS OF WILDLIFE ENHANCEMENT IN IRRIGATED AGRICULTURE: A STUDY OF THE COLUMBIA BASIN IRRIGATION PROJECT,
Washington State Water Research Center, Pullman.
B. F. Wolfley, S. C. Matulich, R. D. Davies, R. L. Shew, and G. H. Bagwell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-104532, Price codes: A16 in paper copy, A01 in microfiche. Report No 31, September 1979. 370 p, 2 fig, 66 tab, 4 append. OWRT C-7165(6213)(6), 14-34-0001-6213.

Descriptors: *Wildlife conservation, *Irrigated agriculture, Columbia basin, Fish and wildlife, Social impacts, Institutional aspects, Economic aspects.

Declining wildlife populations have raised numerous questions concerning the future of public/private fish and wildlife and agricultural benefits created by irrigation development projects. Interrelationships of wildlife and irrigated agriculture were analyzed in terms of social impacts, economic trade-offs, and institutional ramifications. A secondary purpose of this study was to establish tradeoffs among resources committed to agriculture and/or wildlife production. The study was interdisciplinary in nature and involved analyses from social, economic, and political/institutional disciplines. The analytical framework was designed to provide evaluation of the socioeconomic interaction of recreationists and landowners involved in the production and use of wildlife in irrigated agriculture, and to suggest possible means whereby a satisfactory combination of wildlife and agricultural production may be achieved. The institutional ramifications of incorporating irrigation development with wildlife enhancement are presented, and alternatives to assure long-term fish and wildlife benefits are identified. (See also W80-00633)
W80-00634

THE IMPORTANCE OF TRIBUTARY STREAMS TO THE REPRODUCTION OF CATOSTOMIOS AND SAUGER,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
K. D. Curry, and A. Spacie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-104896, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No. 126, August 1979. 82 p, 14 fig, 34 tab, 67 ref, 1 append. OWRT A-052-IND(1).

Descriptors: *Saugers, *Suckers, *Spawning, *Tributaries, Catostomids, Stizostedion, Canadense, Fish reproduction, Streams, Wabash River, Deer Creek, Wildcat Creek.

Suckers (Catostomidae) and sauger (Stizostedion canadense) are important members of the fish community in the Wabash River. It has been hypothesized that river populations of suckers and sauger may be sustained by recruitment of young fish from tributaries. This study examined the importance of a Wabash River tributary to catostomid and sauger reproduction by determining the seasonal presence of adults and larvae within the system. Electrofishing, hoopnet, and blocknet catches on Deer Creek, Carroll County, Indiana, revealed a differential use of the tributary for spawning by species and by age-size groups. White suckers (Catostomus commersoni) were the dominant sucker in the headwaters during spring, while redhorse (Moxostoma) were most abundant in main stem Deer Creek. Shorthead redhorse (M. macrolepidotum) adults were only present in Deer Creek during spawning and did not enter its upper reaches. Spawning groups of golden redhorse (M. erythrurum) and black redhorse (M. duquesnei) were older and larger near the mouth of Deer Creek than spawning groups 12.8 km upstream in Bachelor Run. Adult sauger were collected only rarely in lower Deer and Wildcat Creeks. Their abundance in the tributaries did not increase during spring spawning although mature males and females were frequently captured in the Wabash River. Three adults tracked by radio tags remained in the main river during April.
W80-00637

DEVELOPMENT OF WATER RESOURCES AND ITS INFLUENCE ON THE ECOLOGY OF SAUDI ARABIA,
King Abdulaziz Univ., Jeddah (Saudi Arabia).
H. H. Hajrah.
Advances in Desert and Arid Land Technology and Development, v. 1, Adli Bishay and Wm. G. McGinnies, eds. Harwood Academic Publishers, 1979, p 211-218, 4 tab.

Descriptors: *Saudi Arabia, *Water resources development, *Water shortage, *Comparative productivity, *Alternative water use, *Water allocation(Policy), Arid lands, History, Water utilization, Competing uses, Irrigation engineering, Dams, Reservoirs, Conveyance structures, Desalination.

An analysis of the ecological features of Saudi Arabia's western province including the southwestern and western highlands and seashore, and eastern province including the central Najd Plateau and the eastern seashore on the gulf. Indications are that this largely arid country has scarce water resources of poor quality, no running rivers, and rather restricted amounts of groundwater with low recharge rates to the aquifers by rain. An historical review of cultivated lands and their water systems is presented which shows that a continuous increase in consumption of water for household and drinking purposes has resulted in a decrease of available water for agriculture and a subsequent decrease in productivity of land and farms. Recently, however, dams and reservoirs have been constructed in the southern province and networks of channels established for irrigation. These developments, along with the desalination of Red Sea and Gulf waters and controlled agricultural techniques are advocated here for future development. (Tickes-Arizona)
W80-00640

7. RESOURCES DATA

7A. Network Design

EVALUATION OF ECONOMIC BENEFITS OF HYDROLOGICAL SERVICES,
For primary bibliographic entry see Field 6B.
W80-00414

CURRENT METHODOLOGIES FOR THE COLLECTION AND DISSEMINATION OF WATER RESOURCES DATA IN THE UNITED STATES,
Geological Survey, Reston, VA.
G. H. Davis.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2387-2411.

Descriptors: *Water resources, *Data storage and retrieval, *Data collections, *Information exchange, *Networks, *United States, Information retrieval, Methodology, Meteorological data, Hydrologic data, Data management, Decision making, Planning, Water policy, Research and development, Water management(Applied), Financing, STORET, WATSTORE, Federal government.

U.S. experience in water resources data management shows that: (1) multipurpose hydrologic data acquisition, coordination, compilation, and dissemination are best handled by a fact-finding agency independent of water management agencies; (2) use of hydrologic data in decision-making is a direct measure of the effectiveness of communication between data collector and user; (3) a coordinated system with a broad institutional base should be a first priority; (4) planners, managers, and policymakers must consider the interrelationship of data base and water policy and the influence of methodology on data base adequacy; (5) hydrological and environmental data systems should be coordinated for input into research. Contents of this paper: (1) goals, history, criteria, and gaps of water management and data collection in the U.S.; (2) coordination of water data acquisition; (3) standardization of collection methods; (4) network design; (5) technology of data acquisition regarding precipitation and evaporation, streamflow and stage, water storage, groundwater, stream quality, and sediment transport; (6) data handling, storage, and retrieval; (7) publications; (8) recent advances; and (9) institutional arrangements, funding, and plans. Specific storage systems discussed include meteorological data, the Geological Survey's WATSTORE, and

EPA's STORET. Bureau of the Budget Circular A-67 (1967) assigned responsibility for a national water data network to the Department of the Interior, and in 1966 a catalog of water data was established. (Lynch-Wisconsin)
W80-00474

WATER-RESOURCES INVESTIGATIONS IN NEVADA, 1978.
Geological Survey, Carson City, NV. Water Resources Div.
Geological Survey Water-Resources Investigations in Nevada Folder, 1979. 1 sheet.

Descriptors: *Water resources, *Investigations, *Inter-agency cooperation, *Nevada, Surveys, Planning, Hydrologic data, Basic data collections, Precipitation(Atmospheric), Streamflow, Groundwater, Water quality, On-site investigations, Dissolved solids, Bibliographies, Networks, Maps, *Cooperative water-studies program.

Water-resources studies and investigations in Nevada in which the U.S. Geological Survey participates in cooperation with other agencies are summarized. A bibliography of selected material concerning these investigations is included. The investigations include collections of basic information through a hydrologic-data network, areal hydrologic or interpretative studies, and research projects. The hydrologic-data network consists of primary, secondary, and water management streamflow stations; ground-water observation wells; and water-quality observation sites. Small State maps show average annual precipitation, average annual runoff, flood-prone areas completed in Nevada, principal sources of ground water, discharge of the principal rivers, and the dissolved solids in ground waters. A map, scale 50 miles to the inch, shows by symbols, numbers, and colored outline the hydrologic-data network and investigations in Nevada as of January 1978. (Woodard-USGS)
W80-00776

7B. Data Acquisition

ASSESSMENT OF WATER RESOURCES: NETWORKS, SURVEYS, SERVICES, AND RELATED FACILITIES: PRESENT STATUS AND REQUIREMENTS BY 2000.
World Meteorological Organization, Geneva (Switzerland).
For primary bibliographic entry see Field 6A.
W80-00426

CURRENT METHODOLOGIES FOR THE COLLECTION AND DISSEMINATION OF WATER RESOURCES DATA IN THE UNITED STATES,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 7A.
W80-00474

REMOTE SENSING FOR WATER RESOURCES MANAGEMENT.
Geological Survey, Washington, DC.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press; Vol. 1, part 4, p 2413-2429.

Descriptors: *Remote sensing, *Water management(Applied), *Satellites(Artificial), *Planning, *Aerial photography, *Water resources, *Multispectral scanners, Aircraft, Data collections, Information retrieval, Data storage and retrieval, Meteorological data, Land use, Thermal scanners, United States, Monitoring, Flood control, Water pollution control, Sensors, Erosion, Sedimentation, Turbidity, Water distribution(Applied), Mapping, Inventories, Costs, Landsat.

Remote sensing is useful for water management, complementing ground data and providing information otherwise unobtainable. Limitation include unfamiliar technology, high cost, and delays in processing and delivering information to users. This paper describes remote sensing systems, applications to water resources management, and factors affecting investments in remote sensing (costs, field calibration data, trade-offs, training, and education). Sensors include: (1) color and color-infrared photographic equipment, (2) radiometers, (3) thermal scanners, (4) multispectral scanners (MSS), and (5) active or passive microwave systems. Data can be collected in either analog (image) or digital form. Collection vehicles comprise aircraft (airplanes, helicopters, balloons), and compact, sophisticated satellites. The Landsat MSS has been the sensor of primary interest to most investigators; data are distributed mainly through the EROS Data Center. Water resources applications: weather forecasting, climatic changes, snow and ice dynamics, water circulation, sediment and pollution plumes, and movement, coastal processes, heated effluents, groundwater presence and discharges, soil moisture, geomorphology, beach and other water erosion, evapotranspiration, flood boundaries, drainage basin variables, streamflow, water distribution, lake condition, karst sinks, energy and water balances, gauging site distribution, lake condition, karst sinks, energy and water balances, gauging site selection, land-use planning, model development, and dam or levee seepage. Data Collection System (DOS) refers to real-time data relay via satellite. (Lynch-Wisconsin)
W80-00475

A DMSP NEAR IR SENSOR FOR CLOUD/SNOW DISCRIMINATION,
Westinghouse Electric Corp., Baltimore, MD.
A. W. Kimball, Jr.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 43-47, May 1979. 4 fig, 4 ref.

Descriptors: *Remote sensing, *Snow, *Infrared radiation, Satellites(Artificial), Measurement, Instrumentation, Clouds, Microwaves, Radiometric characteristics.

This presentation described an instrument built to fly on a Defense Meteorological Satellite Program (DMSP) satellite. Sensing reflected sunlight in the 1.5 micrometer region, it is designed to operate in conjunction with the visible channel of the primary sensor to demonstrate feasibility of automatic recognition of clouds over snow fields. The theoretical basis for the instrument was discussed briefly, and salient radiometric characteristics of the instrument were described. Briefly, a 48-element line array of intrinsic Ge detector elements lies in the image plane of a 40.2 degree wide angle lens designed to provide constant angular field of view per array element (14.6 mrad along track, 9.61 mrad along array on 14.6 centers along array), as well as an element illumination loss from center to end of only 12%. The instrument field of view will extend from subtrack perpendicular to the track and toward the sun, covering about 650 km on the earth's surface. To compensate for the variation in scene illumination from near subsolar to the terminator region (and to permit gain variation for enhancement of specific types of low radiance scenery), 16 gain states, spaced at 2.4 dB, are available and may be commanded from the primary sensor memory at specified programmed times along the orbital track. (See also W80-00566) (Humphreys-ISWS)
W80-00570

THE UNITED STATES ENVIRONMENTAL SATELLITE DATA ARCHIVES,
National Climatic Center, Asheville, NC.
E. R. Hoppe.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 49-56, May 1979. 5 ref, 1 append.

Descriptors: *Remote sensing, *Data collections, *Satellites(Artificial), Maps, Data storage and retrieval, Infrared radiation, Reviews, Meteorological data, Hydrologic aspects, Ice, Coasts, Information retrieval, Photography, Films, Data archives, TIROS, LANDSAT, SKYLAB, SEASAT.

The U.S. archives of environmental satellite data represent a unique source of information for various investigations within many scientific disciplines. While primarily intended for meteorological purposes, many of the sensors orbited on the more recent spacecraft also provide data of great value to hydrology and the marine sciences. The data held within the archives consist of imagery in both photographic and digital form, and, while the archives in their present form were initiated only in late 1974, photographic images from the earliest meteorological satellites of the 1960's through the latest geostationary spacecraft are included in the files. The files have been indexed and arranged to facilitate retrieval of data to answer requests. The arrangement has been based on experience gained in the past several years from the type and extent of requests serviced. Most requests have been concerned and primarily identified with a geographical area, a specific date or period, a certain sensor or spectrum, a specific phenomenon of interest, and a specified data resolution--in that order. Thus, the data are first separated by individual satellites with their unique areal coverage, further broken down by date and sensor type, and finally, by resolution or scale. Specific data formats, such as magnetic tape and 35-mm, 70-mm, 25- by 25-cm film, are also maintained in individual files. (See also W80-00566) (Humphreys-ISWS)
W80-00571

SATELLITE-DERIVED RIVER BASIN SNOW-COVER PERCENTAGES: A NEW DATA BASE FOR HYDROLOGISTS,
National Environmental Satellite Service. Washington, DC.
S. R. Schneider.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 57-60, May 1979. 1 fig, 1 tab, 3 ref.

Descriptors: *Snow cover, *Maps, *Remote sensing, *Snow surveys, Satellites(Artificial), Areal, Analytical techniques, Methodology, Hydrology, Data processing, Data collections, Watersheds(Basins), Snowpacks.

Hydrologists at NOAA's National Environmental Satellite Service (NESS) have been producing satellite-derived areal snow cover maps for selected river basins since 1973. Four basins were originally targeted for study, involving a variety of topographic, spatial, and climatological conditions. Heightened user interest, combined with an increase in manpower and equipment resources, has allowed NESS to expand the snow mapping program. During the 1977-1978 snow season, operational coverage was provided for 30 basins in the United States and Canada. Basin snow maps are made on an average of once a week beginning November 1st and terminating when the snowpack appears almost totally depleted on the imagery. The analyses can only be made when the basin is free of obscuring clouds. Accordingly, basins in the Southwestern United States and California's Sierra Nevada are mapped more often than those in the less cloud-free Pacific Northwest. The snow cover data are generally provided to users within 30 hours of a satellite overpass so they can be incorporated into watershed runoff forecast models. (See also W76-0208 and W80-00566) (Humphreys-ISWS)
W80-00572

LANDSAT-DERIVED SNOW COVER AS A FORECAST TOOL IN THE RIO GRANDE BASIN IN COLORADO,
Soil Conservation Service, Denver, CO.
For primary bibliographic entry see Field 2C.
W80-00573

NASA MAPPING PROJECTS (SUMMARY),
National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, MD.
For primary bibliographic entry see Field 7C.
W80-00578

WATER USE INFORMATION FOR PIMA COUNTY, ARIZONA,

Army Corps of Engineers, Los Angeles, CA.
M. F. Thuss.
Pima Association of Governments 208 Project, Element 6, Task 6320, Existing Water Use Overview, March 1978. 116 p, 9 fig, 29 tab, 20 ref.

Descriptors: *Water utilization, *Hydrologic data, *Competing uses, *Water allocation(Policy), *Water supply, Irrigation water, Industrial water, Municipal water, Recreation, Water demand, Water distribution(Applied), Water policy, Water management(Applied), Recharge, Hydrologic budget, Drainage districts, Pima County, Arizona.

Based upon already published information generated by many experts, current water use trends for agricultural, industrial, municipal, and recreational consumption are developed here for specified locations of Pima County, Arizona, including the Ajo area, the Avra and Altar Valleys, the Upper and Lower Santa Cruz, and the Upper and Lower San Pedro areas. The questions of where water is stored, how much water is available to be tapped as a supply, and how much water is replenished each year are addressed in an attempt to establish the water consumption portion of the present time water budget calculation. The water consumption rates for specified areas developed in this analysis are then applied to the PAG-208 drainage basin concepts to provide an accurate estimate of overall future water consumption. (Tickes-Arizona)
W80-00645

7C. Evaluation, Processing and Publication

CURRENT METHODOLOGIES FOR THE COLLECTION AND DISSEMINATION OF WATER RESOURCES DATA IN THE UNITED STATES,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 7A.
W80-00474

DATA SOURCES AND SEA ICE PRODUCTS OF FLEET WEATHER FACILITY/JOINT ICE CENTER, SUITLAND,
Fleet Weather Facility, Suitland, MD.
For primary bibliographic entry see Field 2C.
W80-00568

MAPPING AND ARCHIVING OF CANADIAN SEA ICE DATA,
Atmospheric Environment Service, Downsview (Ontario).
W. E. Markham.
In: Glaciological Data; Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 37-39, May 1979. 8 ref.

Descriptors: *Mapping, *Canada, *Sea ice, *Data collections, Maps, Ice, Ice breakup, Spatial distribution, Areal, Basic data collections, Publications, Ice thickness.

This paper briefly described Canada's ice program. Since 1958, the Atmospheric Environment Service (AES) has conducted ice reconnaissance in most Arctic, subarctic and Eastern Seaboard areas. The products of the AES ice service which are archived include: (1) Thousands of original ice observers' charts at a scale of 1:2,000,000 up to 1977, and recently, 1:1,000,000. (2) Composite ice charts at a scale of 1:4,000,000. (3) Historical ice charts at a scale of 1:6,000,000. (4) Bound copies of Ice Summary and Analysis. (5) An analysis--Ice Thickness Climatology was prepared in 1974. (6) Freezeup and breakup data collected at many Canadian weather stations. Existing Canadian atlases of sea ice are: (1) Ice Atlas of Arctic Canada; (2) Canadian Arctic Ice Atlas; (3) Ice Atlas--Eastern Canadian Seaboard; and (4) Ice Atlas of Canadian Arctic. (See also W80-00566) (Humphreys-ISWS)
W80-00569

ARCHIVING AND MAPPING OF CANADIAN SNOW COVER DATA,
Atmospheric Environment Service, Downsview (Ontario).
For primary bibliographic entry see Field 2C.
W80-00574

ACCURACY OF SNOW AND ICE MONITORING,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 2C.
W80-00575

AN ARCTIC SEA ICE DATA SET, 1901-1956,
University of East Anglia, Norwich (England). Climate Research Unit.
For primary bibliographic entry see Field 2C.
W80-00576

INADEQUACIES IN ARCHIVED SEA ICE DATA,
Sea Ice Consultants, Camp Springs, MD.
For primary bibliographic entry see Field 2C.
W80-00577

NASA MAPPING PROJECTS (SUMMARY),
National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, MD.
H. J. Zwally.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 109-111, May 1979. 1 fig, 2 tab, 2 ref.

Descriptors: *Mapping, *Data storage and retrieval, *Satellites(Artificial), *Data collections, Climatic data, Snow cover, Soil moisture, Vegetation, Precipitation(Atmospheric), Albedo, Ozone, Sea ice, Water temperature, Oceans, Ocean currents, Clouds, Radiation, Solar radiation, Nimbus, Seasat, Landsat, Tiros-N.

It is important to realize the differences among research and development satellites (e.g., Nimbus 1-7 and Seasat-1), quasi-operational satellites (Landsat-1-D), and fully operational satellites (TIROS-N, etc.). Also, there are various levels of data. Some satellite data sources and classification of data set levels were tabulated. Generally, most NASA satellite data are archived at Level I (physical quantities) and are available from National Space Sciences Data Center, Goddard Space Flight Center, Greenbelt, Maryland. However, the archived data vary greatly in quality, accuracy, and documentation. (See also W80-00566) (Humphreys-ISWS)
W80-00578

WATER WITHDRAWALS IN ILLINOIS, 1978,
Illinois State Water Survey, Urbana.
J. R. Kirk, J. Jarboe, E. W. Sanderson, R. T. Sasman, and R. A. Sinclair.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-105992, Price codes: A03 in paper copy, A01 in microfiche. ISWS Circular 140, 1979. 35 p, 4 fig, 7 tab, 39 ref, 1 append.

Descriptors: *Water utilization, *Illinois, *Census, *Data collections, Water supply, Groundwater, Surface waters, Rural areas, Basic data collections, Electric power industry, Industrial water, Municipal water, Cooling water, Irrigation water, Stock water, Wildlife.

This report, part of a continuing cooperative program with the U.S. Geological Survey, summarized the results of the 1978 Illinois Water Use Inventory. The water use data were presented for the following categories: Public Water Supply (1770.9 mgd), Self-Supplied Industry (44,331.0 mgd), Rural Water Use (220.0 mgd), and Fish and Wildlife Management Areas (44.2 mgd). The data were then further categorized by county, districts, hydrologic units, and Standard Metropolitan Statistical Areas. Illinois water withdrawals during 1978 were 46,366.1 mgd, of which groundwater provided 945.7 mgd and surface water sources supplied 45,420.4 mgd. The largest user of water in Illinois is electric power generation, 92% of the total withdrawals. Excluding electric power withdrawals, 1978 groundwater use was 939.5 mgd, and surface water use was 2915.0 mgd. (Humphreys-ISWS)
W80-00722

CONTAMINATION POTENTIAL IN THE SILURIAN DOLOMITE AQUIFER, EASTERN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 5B.
W80-00757

DRAINAGE AREAS OF THE TWELVEPOLE CREEK BASIN, WEST VIRGINIA, BIG SANDY RIVER BASIN, WEST VIRGINIA, TUG FORK BASIN, VIRGINIA, KENTUCKY, WEST VIRGINIA,
Geological Survey, Charleston, WV. Water Resources Div.
M. W. Wilson.
Geological Survey open-file report 79-746, 1979. 50 p, 1 fig, 3 tab.

Descriptors: *Drainage area, *Streams, *Tributaries, *Sites, *Watersheds(Divides), Maps, West Virginia, Virginia, Kentucky, Distance, River miles, *Twelvepole Creek basin, *Big Sandy River basin, *Tug Fork basin.

Drainage areas were determined for 61 basins in the Twelvepole Creek basin, West Virginia; 11 basins of the Big Sandy River Basin, West Virginia; and 210 basins in the Tug Fork basin of Virginia, Kentucky, and West Virginia. Most basins with areas greater than 5 square miles were included. Drainage areas were measured with electronic digitizing equipment, and supplementary measurements were made with a hand planimeter. Stream mileages were determined by measuring, with a graduated plastic strip, distances from the mouth of each stream to the measuring point on that stream. Mileages were reported to the nearest one-hundredth of a mile in all cases. The latitude and longitude of each measuring point was determined with electronic digitizing equipment and is reported to the nearest second. The information is listed in tabular form in downstream order. Measuring points for the basins are located in the tables by intersecting tributaries, by counties, by map quadrangles, or by latitude and longitude. (Woodard-USGS)
W80-00765

WATER-RESOURCES INVESTIGATIONS IN NEVADA, 1978.
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 7A.
W80-00776

WATER RESOURCES DATA FOR WISCONSIN, WATER YEAR 1978.
Geological Survey, Madison, WI. Water Resources Div.
Geological Survey Water-Data Report WI-78-1, April 1979. 488 p, 13 fig.

Descriptors: *Wisconsin, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water-resources data for the 1978 water year for Wisconsin include records of streamflow at gaging stations, partial-record stations, and miscellaneous sites; records of reservoir storage, records of chemical, physical, and biological characteristics of surface water, ground water, and precipitation, and records of water levels in observation wells. Records for a few gaging stations in bordering States also included. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Wisconsin.

W80-00777

WATER RESOURCES DATA FOR SOUTH CAROLINA, WATER YEAR 1978.
Geological Survey, Columbia, SC. Water Resources Div.
Geological Survey Water-Data Report SC-78-1, March 1979. 248 p, 5 fig.

Descriptors: *South Carolina, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for South Carolina consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 57 gaging stations, stage-only records for 1 gaging station, stage and contents for 11 lakes and reservoirs, water quality for 25 gaging stations and 5 ungaged stations, and water levels for 23 observation wells. Also included are 46 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in South Carolina. (Woodard-USGS)
W80-00778

WATER RESOURCES DATA FOR HAWAII AND OTHER PACIFIC AREAS, WATER YEAR 1978--VOLUME 1. HAWAII.
Geological Survey, Honolulu, HI. Water Resources Div.
Geological Survey Water-Data Report HI-78-1, June 1979. 292 p, 14 fig.

Descriptors: *Hawaii, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Volume 1 of water resources data for the 1978 water year for Hawaii consists of records of stage, discharge, and water quality of streams; and water levels and water quality in wells and springs. This report contains discharge records for 114 gaging stations; water quality for 11 gaging stations, 98 partial-record flow stations, and 182 wells; and water levels for 25 observation wells. Also included are 106 crest-stage partial-record stations and 18 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, Federal, and other agencies in Hawaii. (Woodard-USGS)
W80-00779

WATER RESOURCES DATA FOR HAWAII AND OTHER PACIFIC AREAS, WATER YEAR 1978--VOLUME 2. TRUST TERRITORY OF THE PACIFIC ISLANDS, GUAM, AMERICAN SAMOA, AND NORTHERN MARIANA ISLANDS,
Geological Survey, Honolulu, HI. Water Resources Div.
Geological Survey Water-Data Report HI-78-2, June 1979. 108 p, 16 fig, 1 tab.

Descriptors: *Islands, *Pacific Ocean, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Mariana Islands, *Caroline Islands, *Samoa Islands.

Volume 2 of water resources data for the 1978 water year for other Pacific areas (not including Hawaii) consists of records of stage, discharge, and water quality of streams; stage of a reservoir; and water levels in wells and springs. This report contains discharge records for 44 gaging stations, stage only record for 1 gaging station, water quality for 1 gaging station and 5 partial-record stations, water temperature for 35 gaging stations, and water levels for 6 observation wells. Also included are 37 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating governments and Federal agencies in other Pacific areas. (Woodard-USGS)
W80-00780

8. ENGINEERING WORKS

8A. Structures

WORLD EMPLOYMENT PROGRAMME: APPROPRIATE CONSTRUCTION TECHNOLOGY FOR WATER CONTROL AND IRRIGATION WORKS IN DEVELOPING COUNTRIES,
For primary bibliographic entry see Field 6A.
W80-00419

TILLAMOOK BAY ENTRANCE REFRACTION STUDY, TILLAMOOK, OREGON,
Army Engineer Waterway Experiment Station, Vicksburg, MS. Hydraulics Lab.
L. Z. Hales.
Miscellaneous Paper H-77-8, August 1977. 4 fig, 2 tab.

Descriptors: *Waves(Water), *Refraction(Water waves), *Jetties, *Graphical analysis, *Model studies, *Wave theory, *Ocean waves, *Breakwaters, Oregon, Bays, Estuaries, Water circulation, Navigation, Shoals, Shallow water, Mathematical studies, Curves, Statistics, Flow, Currents(Water), Regression analysis, Tides, Tidal effects, Gravity waves.

On May 31-June 10, 1977, U. S. Army Corps of Engineers conducted a series of water refraction analyses for the offshore bar and entrance channel to Tillamook Bay, Oregon, to ascertain effects of extending a south jetty on regional wave characteristics. No specific conclusions were drawn but data were used to assess navigational hazards at the entrance between existing north jetty and proposed south jetty extension. Tillamook Bay is a tidal estuary six mi long and three mi wide with channel depth of 12-18 ft. Five rivers with total drainage of 574 sq mi flow into the bay. An existing north jetty extends 5700 ft and south jetty 4000 ft; a south jetty extension of 1550 ft was proposed to make it 150 ft short of the north jetty. The paper describes surface gravity wave transformations in shoaling water and consequent tidal wave effects. Wave sampling records indicate that conoidal wave shapes can be predicted with wavelength, wave height, and water depth determining wave profile. However, elliptic function complexity and solitary waves limit the conoidal wave theory. A three dimensional wave basin was created to simulate a tidal inlet and examine surface gravity waves. Under ebb flow conditions an area oceanward of the inlet entrance experiences greatest alteration to wave characteristics. (Danovich-Wisconsin)
W80-00501

8B. Hydraulics

DIVIDING-FLOW MANIFOLDS WITH SQUARE-EDGED LATERALS,
Water and Air Research, Inc., Gainesville, FL.
H. E. Hudson, Jr., R. B. Uhler, and R. W. Bailey.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 105, No. EE4, Proceedings Paper 14764, p 745-755, August 1979. 4 fig, 2 tab, 18 ref, 3 append.

Descriptors: *Flow resistance, *Flow separation, *Pipe flow, *Hydraulics, Pipes, Flow, Closed conduit flow, Head loss, Pressure, Junctions, Model studies, Mathematical models, Manifolds, Entrances(Fluid flow), Dividing flow.

A method of analysis for dividing-flow junction losses based on correlation of numerous data sets was presented. Illustrative examples were given to describe the use of the analytical procedure to evaluate dividing manifold problems. The entry loss coefficients for laterals discharging from a dividing-flow manifold were found to bear lineal relationships to the squares of the ratios of manifold-to-lateral velocities. The entry loss coefficients for short laterals were larger than those for long laterals. Since the entry loss characteristic dictates dividing-flow distributions, the preferred design technique will compel equal flow distribution by maintaining the same manifold-to-lateral velocity ratio at every junction point. (Sims-ISWS)
W80-00582

DYE-VECTOR FLOW VISUALIZATION--COOLING WATER MODEL,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
V. W. Harms, and R. L. Wiegel.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, No. WW3, Proceedings Paper 14767, p 293-312, August 1979. 11 fig, 2 tab, 19 ref, 2 append.

Descriptors: *Cooling water, *Model studies, *Hydraulic models, Dye releases, Dyes, Photography, Currents(Water), Flow, Turbulent flow, Circulation, Water circulation, Velocity, Buoyancy, Mixing, Intakes, Discharge(Water), Hydraulics, Powerplants, Heated water, Water pollution, Dye-vector techniques, Flow visualization.

An extensive hydraulic scale model (densimetric Froude law) of the intake and discharge flows of the cooling water system of an ocean coast power plant with coastal currents made use of flow visualization techniques to obtain details of patterns near the discharge and intake. This was important to develop insights to the characteristics of the mixing and induced bottom flows. One technique was to drop dye crystals to the bottom and to photograph (in color) the growth of the dye vectors. This was so useful that a thorough quantitative study was made of the growth rate of these vectors, U sub d, relating the growth rate to the friction velocity, U sub *. The results were interpreted using boundary layer theory and numerical and physical model studies of low Reynolds number flow around objects. For a range of values of U sub * of practical importance in hydraulic model studies over hydraulic smooth bottoms, a linear relationship between U sub * and U sub d was established. (Sims-ISWS)
W80-00586

PERFORMANCE ANALYSIS OF TETHERED FLOAT BREAKWATER,
Scripps Institution of Oceanography, La Jolla, CA.
R. J. Seymour, and D. M. Hanes.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, No. WW3, Proceedings Paper 14755, p 265-280, August 1979. 9 fig, 4 tab, 3 ref, 2 append.

Descriptors: *Breakwaters, *Waves(Water), *Coastal engineering, Model studies, Mathematical models, Hydraulic models, Laboratory tests, On-site investigations, Harbors, Marinas, Ocean waves, Coasts, Energy, Energy dissipation, Engineering, *Tethered float breakwaters.

This report described laboratory experiments at one-half scale using simulated random seas and field tests at full scale of an installation of a dynamic floating breakwater system in a limited fetch situation. An analytical model was described which successfully predicted the performance of a tethered float breakwater configuration, given the incident wave spectrum. The methodology for selecting the arbitrary resistance coefficients in the predictive model was considered. Predicted and measured performance data for a total of 60 laboratory and field experiments were displayed which covered a very broad range of wave climates. (Sims-ISWS)

Group 8B—Hydraulics

W80-00587

SAND BED FRICTION FACTORS FOR OSCILLATORY FLOWS,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 2L.
W80-00734

TURBULENT FLOW IN A DEPTH-LIMITED BOUNDARY LAYER,
Washington Univ., Seattle. Dept. of Oceanography.
A. R. M. Nowell, and M. Church.
Journal of Geophysical Research, Vol. 84, No. C8, p 4816-4824, August 20, 1979. 7 fig, 43 ref.

Descriptors: *Turbulent flow, *Boundary layers, *Model studies, Mathematical models, Hydraulic models, Roughness(Hydraulic), Flow, Velocity, Reynolds number, Turbulence, Boundary processes, Turbulent boundary layers, Hydraulics.

Turbulent flow was investigated at a constant flow Reynolds number in a depth-limited boundary layer. Relative roughness was 0.12. Roughness density (ratio of plan area of elements to total bed area) was varied to cover the range of flow types described by Morris. The effect of roughness density on velocity profile shape factors, energy dissipation, and streamwise kinetic energy confirmed the existence of three types of roughness density-flow interaction, namely, 'skimming', 'wake interaction', and 'isolated roughness' flows. The velocity profiles and kinetic energy measures identified three layers in the vertical profile: an outer layer (y/D greater than 0.35), a wake layer (y/D between 0.35 and 0.10), and an inner region (y/D less than 0.10). The wake layer is produced by strong turbulent action accompanying vortex shedding at intermediate roughness densities. Spectral measurements and calculations of the turbulent macroscale indicated that the spectral shape is affected by the free surface, but that below $y/D = 0.5$ a parametric model using the turbulent Reynolds number in the spectral energy equation adequately describes the spectral shape for all roughness densities. Implications of these results were discussed for the study of shallow, natural flows with high relative roughness. (Sims-ISWS)
W80-00741

LABORATORY SIMULATION OF THE GYRE IN THE ALBORAN SEA,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 2L.
W80-00743

8D. Soil Mechanics

BEST WAYS TO DEWATER DREDGED MATERIAL,
Oklahoma State Univ., Stillwater. Dept. of Geotechnical Engineering.
For primary bibliographic entry see Field 2G.
W80-00733

8E. Rock Mechanics and Geology

DRAINAGE NETWORK POWER,
Southampton Univ. (England). Dept. of Geography.
K. J. Gregory.
Water Resources Research, Vol. 15, No. 4, p 775-777, August 1979. 2 fig, 1 tab, 17 ref.

Descriptors: *Streams, *Networks, *Drainage systems, Geomorphology, Hydrology, Drainage, Floods, Basins, Model studies, *Stream networks, Network power, Drainage basin characteristics, Channel networks.

Although many indices of drainage basin characteristics have been devised and employed in previous studies, there is still a need to identify those indices which have an easily interpreted physical significance to be of use in explanatory models. Whereas stream power has been used in hydraulic studies of river channels, a comparable expression can be developed to denote the potential energy available in the stream network of a drainage basin. An index of drainage network power was obtained as the volume of the channel network divided by the basin relief, and this index expressed the potential energy of the network of channels in the basin. The index may be directly related to flood potential. The index was used in a study of 14 basins in Britain, and it correlated well with mean annual flood obtained from a partial duration series. (Lee-ISWS)
W80-00725

9. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

ALGAL BIOCHEMICAL TRICKS AND CLASSIFICATION,
Hawaii Univ., Honolulu. Sea Grant Coll. Program.
For primary bibliographic entry see Field 5C.
W80-00512

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

GLACIOLOGICAL DATA: WORKSHOP ON SNOW COVER AND SEA ICE DATA.
For primary bibliographic entry see Field 2C.
W80-00566

SNOW AND ICE DATA SETS FOR CLIMATE AND WATER RESOURCE STUDIES WITH PARTICULAR REFERENCE TO NORTH AMERICA,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 2C.
W80-00567

MAPPING AND ARCHIVING OF CANADIAN SEA ICE DATA,
Atmospheric Environment Service, Downsview (Ontario).
For primary bibliographic entry see Field 7C.
W80-00569

THE UNITED STATES ENVIRONMENTAL SATELLITE DATA ARCHIVES,
National Climatic Center, Asheville, NC.
For primary bibliographic entry see Field 7B.
W80-00571

SUBJECT INDEX

2

Efficacy, Uptake and Distribution of Different Herbicides in the Water Hyacinth,
W80-00519 5C

The Response of Coho Salmon and Guppies to 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) in Water,
W80-00651 5A

208 PLANNING
Integrated Planning and Water Quality Management: The Federal Water Pollution Control Act Amendments of 1972 and Coastal Zone Management,
W80-00527 6E

208 WATER QUALITY PLANNING
Implementation Strategies for Public Law 92-500, Section 208,
W80-00524 6E

ABSORPTION
Absorption of Water by Soil: The Constant Flux Boundary Condition,
W80-00596 2G

Uptake, Binding and Clearance of Divalent Cadmium in Glycera Dibranchiata (Annelida: Polychaeta),
W80-00664 5A

Body Burden of Chromium, Copper, Cadmium and Lead in the Neustonic Copepod Anomalocera Patersoni (Pontellidae) Collected from the Mediterranean Sea,
W80-00665 5A

Zinc Uptake in Marine Diatoms,
W80-00669 5A

Uptake of Cadmium by the Eelgrass Zostera Marina,
W80-00789 5A

ACCLIMATION
Acclimation to Ammonia by Tilapia Aurea,
W80-00653 5A

The Temperature Preference of the Three-Spined Stickleback, Gasterosteus Aculeatus L. (Pisces), Collected at Different Seasons,
W80-00797 5A

ACID PRECIPITATION
Deterioration of Water Quality Due to Long Range Transport of Air Pollution,
W80-00458 5G

Detailed Structure of pH in Hydrometeors,
W80-00616 2K

ACID STREAMS
Effects of Acid Mine Drainage on a Southwestern Pennsylvania Stream,
W80-00684 5A

ACIDITY
Detailed Structure of pH in Hydrometeors,
W80-00616 2K

ACIDS
Weak and Strong Acids in the Surface Waters of the Tovdal Region in S. Norway,
W80-00624 2K

Carbonic Acid Anesthesia for Aquatic Organisms,
W80-00786 5A

ACTINOMYCETES
The Source of Muddy Odor in Bream (Abramis Brama) from the Porvoo Sea Area (Gulf of Finland),
W80-00661 5A

ACTIVATED SLUDGE
Environmental Pollution Control Alternatives: Municipal Wastewater,
W80-00544 5D

ACTON (ME)
Flood Hazard Analyses, Little Ossipee River, Towns of Acton, Newfield and Shapleigh, Maine, York County.
W80-00535 2E

ADENOSINE-TRIPHOSPHATE (ATP) ASSAY
The Use of the ATP Assay for Rapid Assessment of Water Quality,
W80-00552 5A

ADMINISTRATION
Experiences in Joint Administration of Border Watercourses,
W80-00452 6A

Swedish Policy for Water Quality Protection,
W80-00454 6E

On Role of Administrative, Economic and Technological Measures in Protection of Surface and Subterranean Water Against Contamination and Depletion,
W80-00465 6E

ADMINISTRATIVE AGENCIES
The Design and Evaluation of Institutional Arrangements for Water Planning and Management,
W80-00431 6E

Policy and Organization of Water Research in the United Kingdom.
W80-00439 6A

Examples of the Organization of Self-Administration in the Water Economy of the Federal Republic of Germany,
W80-00470 6E

AERIAL PHOTOGRAPHY
Remote Sensing for Water Resources Management.
W80-00475 7B

AFRICA
Economic Commission for Africa, Regional Report,
W80-00409 6A

On the Generation of the Seasonal Coastal Upwelling in the Gulf of Guinea,
W80-00608 2L

AGRICULTURAL CHEMICALS
Polychlorinated Biphenyls and Chlorinated Pesticides in Soils of the Everglades National Park and Adjacent Agricultural Areas,
W80-00618 5A

A Preliminary Appraisal of the Impact of Agriculture on Ground-Water Availability in Southwest Georgia,
W80-00770 4B

AGRICULTURAL WASTES
Concentration and Sources of Fecal and Organic Pollution in an Agricultural Watershed,
W80-00687 5A

AGRICULTURE
Water for Agriculture.
W80-00424 4A

Water, Food, and Fiber,
W80-00455 3F

Irrigation Management in Developing Countries: A Suggested Action Programme,
W80-00481 3F

AIR POLLUTION
Deterioration of Water Quality Due to Long Range Transport of Air Pollution,
W80-00458 5G

AIRBORNE TRANSPORT
Deterioration of Water Quality Due to Long Range Transport of Air Pollution,
W80-00458 5G

ALABAMA
Water Quality in Channel Catfish Production Ponds,
W80-00619 5A

ALASKA
Sea Ice Ridging Over the Alaskan Continental Shelf,
W80-00738 2C

ALBORAN SEA
Laboratory Simulation of the Gyre in the Alboran Sea,
W80-00743 2L

ALGAE
The Biochemical Composition of the Larvae of Two Strains of Artemia Salina (L.) Reared on two Different Algal Foods,
W80-00502 5C

Structure and Succession in Rocky Algal Communities of a Temperate Intertidal System,
W80-00504 5C

Survey of Swimming Pool Algae of the Phoenix, Arizona, Metropolitan Area,
W80-00506 5C

Algal Biochemical Tricks and Classification,
W80-00512 5C

ALGAL GROWTH POTENTIAL
Unexpected Response to Vitamin B12 of Dominant Centric Diatoms from the Spring Bloom in the Gulf of Maine (Northeast Atlantic Ocean),
W80-00681 5C

ALTERNATE PLANNING
Projected Water Use and Water Budget Calculations for Pima County, Arizona,
W80-00647 6B

Large Array of Water Conservation Strategies for Pima County, Arizona,
W80-00648 3D

ALTERNATIVE PLANNING
Screening Objectives and Uncertainties in Water Resources Planning,
W80-00551 6A

Applied Water Resource Systems Planning,
W80-00554 6A

Planning for the Rio Colorado: An Overview,
W80-00558 6A

The Mathematical Programming Sequencing Model,
W80-00562 6A

Engineering and Cost Parameters,
W80-00564 6B

ALTERNATIVE WATER USE
Development of Water Resources and its Influence on the Ecology of Saudi Arabia,
W80-00640 6G

AMMONIA
Time Series Analysis of Ammonia in the Passaic River,
W80-00638 5C

Acclimation to Ammonia by Tilapia Aurea,
W80-00653 5A

AMMONIUM COMPOUNDS
The Effect of Intense Fertilization on Migration of Nitrogen Compounds in Soil,
W80-00508 5C

Significance of Sorption Properties of Soils in Predicting the Migration of Nitrogen Compounds into Natural Waters,
W80-00510 5C

ANALYSIS
Cooling Impoundments: Classification and Analysis,
W80-00580 2H

ANALYTICAL TECHNIQUE
Algal Biochemical Tricks and Classification,
W80-00512 5C

ANALYTICAL TECHNIQUES
World Employment Programme: Appropriate Construction Technology for Water Control and Irrigation Works in Developing Countries,
W80-00419 6A

Water for the Thousand Millions,
W80-00432 6A

Long-Term Planning of Water Management,
W80-00434 6A

The Use of the ATP Assay for Rapid Assessment of Water Quality,
W80-00552 5A

A Comparison of Dynamic and Static Head Space and Solvent Extraction Techniques for the Determination of Trihalomethanes in Water,
W80-00617 5A

ANESTHETICS
Comparison of Anesthetic Potency of Benzocaine Hydrochloride and MS-222 in Two Freshwater Fish Species,
W80-00784 5A

Carbonic Acid Anesthesia for Aquatic Organisms,
W80-00786 5A

ANIMAL GROWTH
Reduction of Aquatic Vegetation Following the Colonization of a Northern Swedish Lake by the Muskrat, Ondatra Zibethica,
W80-00513 5C

Toxic Effects of Aqueous Extracts of Ekofisk Crude Oil, Crude Oil Fractions, and Commercial Oil Products on the Development of Sea Urchin Eggs,
W80-00798 5A

ANIMAL PHYSIOLOGY
Total and Methylmercury Levels in Three Species of Whelks,
W80-00656 5A

Trace Metals in Seaducks of the Fraser River Delta Intertidal Area, British Columbia,
W80-00657 5A

ANISOTROPY
Modeling Groundwater Flow Fields Containing Point Singularities: A Technique for Singularity Removal,
W80-00609 2F

ANNELIDS
Uptake, Binding and Clearance of Divalent Cadmium in Glycera Dibranchiata (Annelida: Polychaeta),
W80-00664 5A

ANTARCTIC
Ultrasonic Velocity Investigations of Crystal Anisotropy in Deep Ice Cores from Antarctica,
W80-00739 2C

ANTIMYCIN
Toxicity of Fishery Chemicals to the Asiatic Clam, Corbicula Manilensis,
W80-00785 5A

APPROPRIATENESS
Water for the Thousand Millions,
W80-00432 6A

APPROPRIATION
Appropriative Water Rights and Efficient Allocation of Resources,
W80-00548 6E

APPROPRIATIVE RIGHTS
Appropriative Water Rights and Efficient Allocation of Resources,
W80-00548 6E

AQUATIC ALGAE
Measurement of Complexing Materials Excreted from Algae and Their Ability to Ameliorate Copper Toxicity,
W80-00667 5A

AQUATIC ENVIRONMENT
Mass Transfer Models of Sorption and Desorption of Radionuclides by Aquatic Plants,
W80-00705 2A

Modelling of the Eutrophication Process in Lakes and Reservoirs,
W80-00718 2H

AQUATIC HABITAT
Instream Flow Strategies for Washington,
W80-00531 6E

Instream Flow Strategies for California,
W80-00532 6E

AQUATIC LIFE
New Aspects of the Consideration of Feedback Mechanisms in an Ecological Model of the Pelagic Zone,
W80-00715 2H

AQUATIC PLANTS
Reduction of Aquatic Vegetation Following the Colonization of a Northern Swedish Lake by the Muskrat, Ondatra Zibethica,
W80-00513 5C

AQUATIC WEED CONTROL
Efficacy, Uptake and Distribution of Different Herbicides in the Water Hyacinth,
W80-00519 5C

AQUICULTURE
Integration of Thermal and Food Processing Residuals into a System for Commercial Culture of Freshwater Shrimp. (Power Plant Waste Heat Utilization in Aquaculture)., Volume II,
W80-00497 3C

Comparison of Anesthetic Potency of Benzocaine Hydrochloride and MS-222 in Two Freshwater Fish Species,
W80-00784 5A

AQUIFER CHARACTERISTICS
Digital Model of the Hollister Valley Ground-Water Basin, San Benito County, California,
W80-00756 6A

Ground-Water Conditions and Potential for Artificial Recharge in Lucerne Valley, San Bernardino County, California,
W80-00763 4B

AQUIFER MANAGEMENT
Ground Water in Dale Valley, New York,
W80-00768 4B

AQUIFER SYSTEMS
A Method of Aquifer Testing and Its Application to an Anisotropic Inhomogeneous Multiple Aquifer System,
W80-00727 2F

AQUIFER TESTING
A Method of Aquifer Testing and Its Application to an Anisotropic Inhomogeneous Multiple Aquifer System,
W80-00727 2F

Ground-Water Appraisal for the Community of Kiryas Joel, Orange County, New York,
W80-00759 2A

AQUIFERS
The Response of Groundwater Systems to Drought,
W80-00462 4B

Methods of Ground-Water Protection from Pollution,
W80-00463 4B

A Method of Aquifer Testing and Its Application to an Anisotropic Inhomogeneous Multiple Aquifer System,
W80-00727 2F

Contamination Potential in the Silurian Dolomite Aquifer, Eastern Wisconsin,
W80-00757 5B

ARCTIC
Glaciological Data: Workshop on Snow Cover and Sea Ice Data.
W80-00566 2C

An Arctic Sea Ice Data Set, 1901-1956,
W80-00576 2C

Inadequacies in Archived Sea Ice Data,
W80-00577 2C

ARGENTINA
Extension of River Flow Records in Argentina from Long Tree-Ring Chronologies,
W80-00731 2E

ARID LANDS
Note to the United Nations Water Conference on Preparations for the United Nations Conference on Desertification.
W80-00422 2A

Water Resources Development, and Management Planning in Arid Zones: Case History-Israel,
W80-00457 6A

Israel- A Model of Efficient Utilization of a Country's Water Resources,
W80-00471 6E

Increasing Available Water Supplies Through Weather Modification and Desalination,
W80-00479 2B

ARIZONA
Statistical Summaries of Arizona Streamflow Data,
W80-00771 2E

ARKANSAS RIVER BASIN
Planning Status Report, Water Resources Appraisals for Hydroelectric Licensing: Lower Arkansas River Basin-Arkansas, Colorado, Kansas, New Mexico, Oklahoma and Texas,
W80-00533 6D

AROMATIC COMPOUNDS
Interactive Effects of Salinity, Temperature and Polycyclic Aromatic Hydrocarbons on the Survival and Development Rate of Larvae of the Mud Crab Rhithropanopeus Harrisii,
W80-00790 5A

ARSENIC
The Concentration and Speciation of Arsenic in Marine Macro-Algae,
W80-00658 5A

Some Observations on Pollutants of Velsao Bay (GOA),
W80-00688 5A

ARSENIC COMPOUNDS
The Concentration and Speciation of Arsenic in Marine Macro-Algae,
W80-00658 5A

ARTESIAN AQUIFERS
Ground Water in Dale Valley, New York,
W80-00768 4B

ARTIFICIAL RECHARGE
The Main Directions of Hydrogeological Investigations for the Substantiation of Artificial Recharge,
W80-00468 2A

ASIA
Report of the ESCAP Regional Preparatory Meeting for the United Nations Water Conference.
W80-00406 6A

ASSESSMENTS
Assessment of Water Resources: Networks, Surveys, Services, and Related Facilities: Present Status and Requirements by 2000.
W80-00426 6A

ASWAN HIGH DAM (EGYPT)
The Environmental Impacts of the Aswan High Dam,
W80-00446 5C

ATLANTIC OCEAN
Isotopic Composition of River Runoff on the U.S. East Coast: Evaluation of Stable Isotope Versus Salinity Plots for Coastal Water Mass Identification,
W80-00607 2L

On the Generation of the Seasonal Coastal Upwelling in the Gulf of Guinea,
W80-00608 2L

Distribution of Suspended Bacteria in Neritic Waters South of Long Island During Stratified Conditions,
W80-00627 2L

The Production and Fate of Phytoplankton Size Fractions in the Plume of the Hudson River, New York Bight,
W80-00628 2L

Summertime Synoptic Variability of the Middle Atlantic Shelf Water/Slope Water Front,
W80-00740 2L

ATLANTIC SALMON
The Survival of Smolts of Salmon Salmo Salar L. at Low Concentrations of Dissolved Oxygen,
W80-00655 5A

ATLANTIC TOMCOD
Hepatomas in Atlantic Tomcod Microgadus Tomcod (Walbaum) Collected in the Hudson River Estuary in New York,
W80-00675 5B

AUBURN (AL)
Water Quality in Channel Catfish Production Ponds,
W80-00619 5A

AUSTRALIA
Establishment of Quality Criteria for Water Use in Australia,
W80-00460 6E

Inter-State Rivers in Australia,
W80-00461 6E

The Response of Groundwater Systems to Drought,
W80-00462 4B

A Method of Aquifer Testing and Its Application to an Anisotropic Inhomogeneous Multiple Aquifer System,
W80-00727 2F

A Statistical Method for Modelling the Fate of Rainfall in a Tropical Rainforest Catchment,
W80-00748 2E

Evaporation from Vegetation in Landscapes Developing Secondary Salinity Using the Ventilated-Chamber Technique, I. Comparative Transpiration from Juvenile Eucalyptus Above Saline Groundwater Seeps,
W80-00755 2I

AUSTRIA
Computerized Optimization of Water Releases from Reservoirs,
W80-00445 4A

AUTOMOTIVE VEHICLES
Water-Quality Assessment of Runoff from a Rural Highway Bridge Near Tallahassee, Florida,
W80-00767 5B

BACTERIA
Distribution of Suspended Bacteria in Neritic Waters South of Long Island During Stratified Conditions,
W80-00627 2L

BACTERIOPHAGES
Effectiveness of Sand Filters for Bacteriophage Escherichia Coli T1 Removal Using Calcium as an Aid,
W80-00493 5D

BALTIC SEA
Phytoplankton in the Coastal Waters of the Bothnian Bay Off Kemi,
W80-00518 5C

BANK EROSION
An Analysis of the Processes of River Bank Erosion,
W80-00612 2J

BASIC DATA COLLECTIONS
Resources and Needs: Assessment of the World Water Situation,
W80-00401 6A

BASIC NEEDS
Basic Needs Strategy and Water Resources Policy,
W80-00418 6A

BATON ROUGE (LA)
Flood Plain Information: Baton Rouge, Louisiana, No 4, Hurricane Creek, Monte Sano Bayou and Tributaries,
W80-00541 2E

BAY OF BOTHNIA
Phytoplankton in the Coastal Waters of the Bothnian Bay Off Kemi,
W80-00518 5C

BAYER 73
Toxicity of Fishery Chemicals to the Asiatic Clam, Corbicula Manilensis,
W80-00785 5A

BAYOU BONFOUCA (LA)
Flood Plain Information: Bayou Bonfouca-Bayou Vincent W-14 Main Diversion Canal Doubloon Branch-French Branch, Slidell, Louisiana and Vicinity,
W80-00536 2E

BEACHES
Energetics of Breaking Waves Within the Surf Zone,
W80-00737 2L

BED FORMS
Sand Bed Friction Factors for Oscillatory Flows,
W80-00734 2L

BEDS
Sand Bed Friction Factors for Oscillatory Flows,
W80-00734 2L

BEHAVIOR
An Analysis of Values for Development of Recreational Policy,
W80-00500 6A

BENEFITS
Economic Parameters,
W80-00563 6B

BENTHIC FAUNA
Foraminifera in Brackish-Water Ponds Designed for Waste Control and Aquaculture Studies in North Carolina,
W80-00523 5C

The Effects of Pollution-Induced Oxygen Deficiency on the Benthos in Elefsis Bay, Greece,
W80-00690 5C

BENZENE
Sensitivity of Alaskan Freshwater and Anadromous Fishes to Prudhoe Bay Crude Oil and Benzene,
W80-00660 5A

BENZOCAINE HYDROCHLORIDE
Comparison of Anesthetic Potency of Benzocaine Hydrochloride and MS-222 in Two Freshwater Fish Species,
W80-00784 5A

BIBLIOGRAPHIES
Water Resources, Planning and Management: A Select Bibliography,
W80-00438 6A

BIG SANDY RIVER BASIN
Drainage Areas of the Twelvepole Creek Basin, West Virginia, Big Sandy River Basin, West Virginia, Tug Fork Basin, Virginia, Kentucky, West Virginia,
W80-00765 7C

BIOACCUMULATION
A History of Mercury Levels in Swedish Fauna,
W80-00649 5A

Total and Methylmercury Levels in Three Species of Whelks,
W80-00656 5A

Trace Metals in Seaducks of the Fraser River Delta Intertidal Area, British Columbia,
W80-00657 5A

Uptake, Binding and Clearance of Divalent Cadmium in Glycera Dibranchiata (Annelida: Polychaeta),
W80-00664 5A

Body Burden of Chromium, Copper, Cadmium and Lead in the Neustonic Copepod Anomalocera Patersoni (Pontellidae) Collected from the Mediterranean Sea,
W80-00665 5A

Zinc Uptake in Marine Diatoms,
W80-00669 5A

Study of Metal Contents of Elasmobranch Fishes: Part I-Metal Concentration in the Muscle Tissues of a Dogfish, Squalus Mitsukurii,
W80-00685 5A

Analysis of Toxicity Data for California Marine Water Quality Standards,
W80-00689 5C

BIOACCUMULATION

Uptake of Cadmium by the Eelgrass Zostera Marina,
W80-00789 5A

The Rock Oyster Saccostrea Glomerata as an Indicator of Trace Metals in Hong Kong,
W80-00793 5A

Chronic Toxicity of Vanadium to Flagfish,
W80-00795 5A

Toxic Effects of Aqueous Extracts of Ekofisk Crude Oil, Crude Oil Fractions, and Commercial Oil Products on the Development of Sea Urchin Eggs,
W80-00798 5A

BIOASSAY
Mutagenic Activity in Organic Wastewater Concentrates,
W80-00670 5A

BIOINDICATOR
Electric Fish as a Tool for Water Quality Assessment,
W80-00659 5A

BIOINDICATORS
A Dynamic Model of the Chemical Nutrient System for Research of the Ecological Consequences in Natural Water,
W80-00701 5B

Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

The Rock Oyster Saccostrea Glomerata as an Indicator of Trace Metals in Hong Kong,
W80-00793 5A

The Use of Chironomid Pupal Exuviae in the Surveillance of Sewage Pollution Within a Drainage System,
W80-00794 5A

BIOLOGICAL COMMUNITIES
Structure and Succession in Rocky Algal Communities of a Temperate Intertidal System,
W80-00504 5C

A Survey of the Biota, Environment and Use for Recreation of Twelve Lakes in Snowdonia,
W80-00699 5C

BIOLOGICAL PROPERTIES
Application of the Aquatic Model Cleaner to a Stratified Reservoir System,
W80-00520 5C

BIOMASS
Can Planktovorous Fish Keep in Check Planktonic Crustacean Populations. A Test of Size-Efficiency Hypothesis in Typical Polish Lakes,
W80-00505 5C

BOONE COUNTY (KY)
Flood Plain Information: Ohio River, Boone County, Kentucky,
W80-00539 2E

BOTTOM SEDIMENTS
Effects of Bottom Sediments on the Survival of Enterobacter Aerogenes in Seawater,
W80-00662 5A

BOUNDARY LAYERS
Turbulent Flow in a Depth-Limited Boundary Layer,
W80-00741 8B

BOUNDARY PROCESSES
Energy Exchange Between Deep Lakes and the Atmosphere and the Consequences for the Wind-Mixed Layer Dynamics,
W80-00713 2L

BREAKWATERS
Tillamook Bay Entrance Refraction Study, Tillamook, Oregon,
W80-00501 8A

Performance Analysis of Tethered Float Breakwater,
W80-00587 8B

BREAM
The Source of Muddy Odor in Bream (Abramis Brama) from the Porvoo Sea Area (Gulf of Finland),
W80-00661 5A

BRIDGES
Water-Quality Assessment of Runoff from a Rural Highway Bridge Near Tallahassee, Florida,
W80-00767 5B

BRIENOMYRUS
Electric Fish as a Tool for Water Quality Assessment,
W80-00659 5A

BRINE SHRIMP
The Biochemical Composition of the Larvae of Two Strains of Artemia Salina (L.) Reared on two Different Algal Foods,
W80-00502 5C

BRINES
Chemical Aspects of a Brine Pool at the East Flower Garden Bank, Northwestern Gulf of Mexico,
W80-00626 2K

BRITISH COLUMBIA
Importance of Lake-River Interaction on Seasonal Patterns in the General Circulation of Kamloops Lake, British Columbia,
W80-00631 2H

CADMIUM
Effects of Oral Administration of Cadmium on Fish-V Effects on Calcium and Inorganic Phosphorus Excretion in the Carp,
W80-00663 5A

Uptake, Binding and Clearance of Divalent Cadmium in Glycera Dibranchiata (Annelida: Polychaeta),
W80-00664 5A

Body Burden of Chromium, Copper, Cadmium and Lead in the Neustonic Copepod Anomalocera Patersoni (Pontellidae) Collected from the Mediterranean Sea,
W80-00665 5A

The Effect of Cadmium and Lead on the Growth of Two Species of Marine Phytoplankton with Particular Reference to the Development of Tolerance,
W80-00676 5A

Acute Toxicity of Copper, Cadmium and Zinc to Three Species of Marine Copepod,
W80-00679 5A

Study of Metal Contents of Elasmobranch Fishes: Part I-Metal Concentration in the Muscle Tissues of a Dogfish, Squalus Mitsukurii,
W80-00685 5A

Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

Uptake of Cadmium by the Eelgrass Zostera Marina,
W80-00789 5A

The Rock Oyster Saccostrea Glomerata as an Indicator of Trace Metals in Hong Kong,
W80-00793 5A

CALIFORNIA
Instream Flow Strategies for California,
W80-00532 6E

Analysis of Toxicity Data for California Marine Water Quality Standards,
W80-00689 5C

CANADA
River Basin Planning in Canada,
W80-00472 6A

Boundary Waters Management,
W80-00480 6E

Mapping and Archiving of Canadian Sea Ice Data,
W80-00569 7C

Archiving and Mapping of Canadian Snow Cover Data,
W80-00574 2C

Importance of Lake-River Interaction on Seasonal Patterns in the General Circulation of Kamloops Lake, British Columbia,
W80-00631 2H

CANALS
U.S. Inland Water Transportation,
W80-00473 6E

CAPITAL-INTENSIVE
World Bank: An Approach for Selection of Labour Vs. Capital Intensive Technologies for Water Resource Development Projects.
W80-00412 6C

CARBON
Phytoplankton Succession in Nutrient Enriched Experimental Ponds As Related to Changing Carbon, Nitrogen, and Phosphorus Conditions,
W80-00517 5C

CARBON DIOXIDE
Nephrocalcinosis in Rainbow Trout Salmo Gairdneri Richardson; The Effect of Exposure to Elevated CO2 Concentrations,
W80-00674 5A

CARBONIC ACID
Carbonic Acid Anesthesia for Aquatic Organisms,
W80-00786 5A

CAROLINE ISLANDS
Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 2. Trust Territory of the Pacific Islands, Guam, American Samoa, and Northern Mariana Islands,
W80-00780 7C

CARP
Comparison of Anesthetic Potency of Benzocaine Hydrochloride and MS-222 in Two Freshwater Fish Species,
W80-00784 5A

CEDAR RIVER (WASH)
Flood Profiles Along the Cedar River, King County, Washington,
W80-00760 2E

CENSUS
Water Withdrawals in Illinois, 1978,
W80-00722 7C

CENTRAL US
Long-Term Availability of Water Resources for Energy Development in the Central United States,
W80-00499 6D

CHANNEL CATFISH
Water Quality in Channel Catfish Production Ponds,
W80-00619 5A

CHANNEL IMPROVEMENT
Geomorphic Study of Upper Mississippi River,
W80-00585 2E

The Effects of Channelization on Furbearers and Furbearer Habitat,
W80-00800 5C

CHANNELIZATION
Floral and Faunal Changes in Lowland Hardwood Forests in Missouri Resulting from Channelization, Drainage, and Impoundment,
W80-00528 6G

CHEMICAL ANALYSIS
Trace Analysis of Phosphates in Small Aqueous Volumes,
W80-00589 5A

Evaluation of an Enzymatic Method for Orthophosphate Determination in Freshwaters,
W80-00625 5A

Stormwater-Runoff Data for a Commercial Area, Broward County, Florida,
W80-00772 4C

CHEMICAL PROPERTIES
Water Quality Investigation of Estuaries of Georgia, 1976,
W80-00553 2L

Comparison of Selected Cultural, Physical, and Water-Quality Characteristics of Lakes in Washington,
W80-00766 2H

Comparison of Anesthetic Potency of Benzocaine Hydrochloride and MS-222 in Two Freshwater Fish Species,
W80-00784 5A

Carbonic Acid Anesthesia for Aquatic Organisms,
W80-00786 5A

CHEMICALS
Toxic Substances in Water--The U.S. Experience.
W80-00456 5G

CHEMISTRY
Survey of Swimming Pool Algae of the Phoenix, Arizona, Metropolitan Area,
W80-00506 5C

CHLORINATED HYDROCARBON
Metabolism of Toxaphene by Aquatic Sediment and a Camphor-Degrading Pseudomonad,
W80-00511 5C

CHLORINATED HYDROCARBON PESTICIDES
Polychlorinated Biphenyls and Chlorinated Pesticides in Soils of the Everglades National Park and Adjacent Agricultural Areas,
W80-00618 5A

CHLORINATION
The Use of the ATP Assay for Rapid Assessment of Water Quality,
W80-00552 5A

CHLORINE
Persistence of Chlorine in Cooling Water from Electric Generating Station,
W80-00581 5A

CHROMIUM
Body Burden of Chromium, Copper, Cadmium and Lead in the Neustonic Copepod Anomalocera Patersoni (Pontellidae) Collected from the Mediterranean Sea,
W80-00665 5A

CIRCULATION
An Assessment of the Effects of Bathymetric Changes Associated with Sand and Gravel Mining on Tidal Circulation in the Lower Bay of New York Harbor,
W80-00693 2J

The Impact of Dredged Holes on Oxygen Demand in the Lower Bay, New York Harbor,
W80-00694 4C

CITRUS COUNTY
Evaluation of a Digital Model for Estuarine Water Quality Simulation in Waste Allocation Studies,
W80-00761 5B

CLAMS
Toxicity of Fishery Chemicals to the Asiatic Clam, Corbicula Manilensis,
W80-00785 5A

Modified Venture Suction Sampler for Collecting Asiatic Clams,
W80-00787 5A

CLASSIFICATION
Algal Biochemical Tricks and Classification,
W80-00512 5C

Cooling Impoundments: Classification and Analysis,
W80-00580 2H

A Survey of the Biota, Environment and Use for Recreation of Twelve Lakes in Snowdonia,
W80-00699 5C

CLOUD SEEDING
Silver Concentration in Rainwater from Seeded and Nonseeded Florida Cumuli: 1973-1975 Results,
W80-00736 2B

CLOUD SETTING
Non Conventional Water Resources: Some Advances in their Development,
W80-00429 3C

COAL MINE WASTES
Effects of Acid Mine Drainage on a Southwestern Pennsylvania Stream,
W80-00684 5A

COASTAL DEVELOPMENT
Guidelines for Urban Development in Louisiana's Coastal Wetlands,
W80-00547 4C

COASTAL ENGINEERING
Performance Analysis of Tethered Float Breakwater,
W80-00587 8B

Sand Bed Friction Factors for Oscillatory Flows,
W80-00734 2L

COASTAL ENVIRONMENTS
Guidelines for Urban Development in Louisiana's Coastal Wetlands,
W80-00547 4C

COASTAL ZONE MANAGEMENT
Integrated Planning and Water Quality Management: The Federal Water Pollution Control Act Amendments of 1972 and Coastal Zone Management,
W80-00527 6E

Guidelines for Urban Development in Louisiana's Coastal Wetlands,
W80-00547 4C

COASTAL ZONE MANAGEMENT PROGRAM
Coastal Zone Management In The United States,
W80-00478 6E

COASTS
Coastal Zone Management In The United States,
W80-00478 6E

Phytoplankton in the Coastal Waters of the Bothnian Bay Off Kemi,
W80-00518 5C

On the Generation of the Seasonal Coastal Upwelling in the Gulf of Guinea,
W80-00608 2L

Degradation of Selected Polycyclic Aromatic Hydrocarbons in Coastal Sediments: Importance of Microbes and Polychaete Worms,
W80-00613 5A

The Production and Fate of Phytoplankton Size Fractions in the Plume of the Hudson River, New York Bight,
W80-00628 2L

Energetics of Breaking Waves Within the Surf Zone,
W80-00737 2L

Low-Frequency Sea Level and Current Fluctuations Along the Coast of Northwest Italy,
W80-00742 2L

COLIFORMS
Effects of Bottom Sediments on the Survival of Enterobacter Aerogenes in Seawater,
W80-00662 5A

Concentration and Sources of Fecal and Organic Pollution in an Agricultural Watershed,
W80-00687 5A

COLORADO
Landsat-Derived Snow Cover as a Forecast Tool in the Rio Grande Basin in Colorado,
W80-00573 2C

COLORADO RIVER BASIN
Colorado River Basin Water Problems: How to Reduce Their Impact,
W80-00545 6E

COMPARATIVE PRODUCTIVITY
Development of Water Resources and its Influence on the Ecology of Saudi Arabia,
W80-00640 6G

COMPETING USES
Water Use Information for Pima County, Arizona,
W80-00645 7B

Large Array of Wastewater Reuse Options for Pima County, Arizona,
W80-00646 6B

Projected Water Use and Water Budget Calculations for Pima County, Arizona,
W80-00647 6B

COMPETITION
Growth and Competition of the Marine Diatoms Phaeodactylum Tricornutum and Thalassiosira Pseudonana, I. Nutrient Effects,
W80-00515 5C

COMPREHENSIVE PLANNING
River Basin Planning in Canada,
W80-00472 6A

Coastal Zone Management In The United States,
W80-00478 6E

Water Resources and Land Reclamation in Egypt,
W80-00643 6B

Large Array of Water Conservation Strategies for Pima County, Arizona,
W80-00648 3D

COMPUTER MODELS
Computerized Optimization of Water Releases from Reservoirs,
W80-00445 4A

Ground Water in Dale Valley, New York,
W80-00768 4B

CONFERENCES
Glaciological Data: Workshop on Snow Cover and Sea Ice Data.
W80-00566 2C

CONIFEROUS TREES
Extension of River Flow Records in Argentina from Long Tree-Ring Chronologies,
W80-00731 2E

CONNATE WATER
Trace Analysis of Phosphates in Small Aqueous Volumes,
W80-00589 5A

CONSTRAINTS
The Mathematical Programming Screening Model,
W80-00559 6A

CONSTRUCTION
World Employment Programme: Appropriate Construction Technology for Water Control and Irrigation Works in Developing Countries,
W80-00419 6A

Sediment and Nutrient Yield from Residential Construction Sites,
W80-00622 5B

CONTINENTAL SHELF
Sea Ice Ridging Over the Alaskan Continental Shelf,
W80-00738 2C

Summertime Synoptic Variability of the Middle Atlantic Shelf Water/Slope Water Front,
W80-00740 2L

COOLING WATER
Cooling Impoundments: Classification and Analysis,
W80-00580 2H

Persistence of Chlorine in Cooling Water from Electric Generating Station,
W80-00581 5A

Dye-Vector Flow Visualization--Cooling Water Model,
W80-00586 8B

COOPERATIVE WATER-STUDIES PROGRAM
Water-Resources Investigations in Nevada, 1978.
W80-00776 7A

COPEPODS
Body Burden of Chromium, Copper, Cadmium and Lead in the Neustonic Copepod Anomalocera Patersoni (Pontellidae) Collected from the Mediterranean Sea,
W80-00665 5A

Effects of Kuwait Oils on Feeding Rates of Copepods,
W80-00666 5A

Acute Toxicity of Copper, Cadmium and Zinc to Three Species of Marine Copepod,
W80-00679 5A

COPPER
Body Burden of Chromium, Copper, Cadmium and Lead in the Neustonic Copepod Anomalocera Patersoni (Pontellidae) Collected from the Mediterranean Sea,
W80-00665 5A

Measurement of Complexing Materials Excreted from Algae and Their Ability to Ameliorate Copper Toxicity,
W80-00667 5A

Acute Toxicity of Copper, Cadmium and Zinc to Three Species of Marine Copepod,
W80-00679 5A

Some Observations on Pollutants of Velsao Bay (GOA),
W80-00688 5A

A Morphometric Study of Lead and Copper Effects on Diatoma Tenue Var. Elongatum (Bacillariophyta),
W80-00782 5A

Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

The Rock Oyster Saccostrea Glomerata as an Indicator of Trace Metals in Hong Kong,
W80-00793 5A

COST ANALYSIS
Analysis of Operations and Maintenance Costs for Municipal Wastewater Treatment Systems,
W80-00549 6B

COST-BENEFIT ANALYSIS
Evaluation of Economic Benefits of Hydrological Services,
W80-00414 6B

Ways to Resolve Critical Water Resources Issues Facing the Nation,
W80-00546 6E

Irrigation Technology for Desert Land Reclamation,
W80-00641 3F

COST PARAMETERS
Engineering and Cost Parameters,
W80-00564 6B

COSTS
Assessment of Water Resources: Networks, Surveys, Services, and Related Facilities: Present Status and Requirements by 2000.
W80-00426 6A

CRABS
Interactive Effects of Salinity, Temperature and Polycyclic Aromatic Hydrocarbons on the Survival and Development Rate of Larvae of the Mud Crab Rhithropanopeus Harrisii,
W80-00790 5A

CROP PRODUCTION
Water for Agriculture.
W80-00424 4A

Water, Food, and Fiber,
W80-00455 3F

Irrigation Management in Developing Countries: A Suggested Action Programme,
W80-00481 3F

CRUDE OIL
Sensitivity of Alaskan Freshwater and Anadromous Fishes to Prudhoe Bay Crude Oil and Benzene,
W80-00660 5A

Effects of Kuwait Oils on Feeding Rates of Copepods,
W80-00666 5A

Toxic Effects of Aqueous Extracts of Ekofisk Crude Oil, Crude Oil Fractions, and Commercial Oil Products on the Development of Sea Urchin Eggs,
W80-00798 5A

CRUSTACEANS
Can Planktovorous Fish Keep in Check Planktonic Crustacean Populations. A Test of Size-Efficiency Hypothesis in Typical Polish Lakes,
W80-00505 5C

CRYSTALS
Ultrasonic Velocity Investigations of Crystal Anisotropy in Deep Ice Cores from Antarctica,
W80-00739 2C

CTENOPHORES
Mixing an Enclosed, 1300 Cubic Meter Water Column: Effects on the Planktonic Food Web,
W80-00672 5A

CURRENTS (WATER)
Low-Frequency Sea Level and Current Fluctuations Along the Coast of Northwest Italy,
W80-00742 2L

The Use of the Salinity Maximum of the Equatorial Undercurrent for Estimating Nutrient Enrichment and Primary Production in the Gulf of Guinea,
W80-00781 5C

CYANOPHYTA
The Source of Muddy Odor in Bream (Abramis Brama) from the Porvoo Sea Area (Gulf of Finland),
W80-00661 5A

CYCLES
The Diatomflora of a Small Stream Near Abisko (Swedish Lapland) and Its Annual Periodicity, Judged by Drift and Colonization,
W80-00516 5C

CYCLING NUTRIENTS
Phosphorus Cycling in Alaskan Coastal Tundra: A Hypothesis for the Regulation of Nutrient Cycling,
W80-00503 5C

CYPRESS BAYOU (LA)
Flood Plain Information: Baton Rouge, Louisiana, No. 5, Cypress Bayou and Tributaries,
W80-00540 2E

CYTOLOGICAL STUDIES
Algal Biochemical Tricks and Classification,
W80-00512 5C

CZECHOSLOVAKIA
Hydrological and Geochemical Mass Balance in Small Forested and Agricultural Basins,
W80-00703 2A

DALE VALLEY (NY)
Ground Water in Dale Valley, New York,
W80-00768 4B

DAMS
Environmental Issues in River Basin Development,
W80-00433 2A

Inter Basin Water Transfers in South Africa,
W80-00483 6D

DANUBE RIVER BASIN
Environmental Aspects of Pollution Control in Hungary,
W80-00441 6A

DARLING RIVER (AUSTRALIA)
Inter-State Rivers in Australia,
W80-00461 6E

DATA COLLECTIONS
Evaluation of Economic Benefits of Hydrological Services,
W80-00414 6B

Current Methodologies for the Collection and Dissemination of Water Resources Data in the United States,
W80-00474 7A

Data Sources and Sea Ice Products of Fleet Weather Facility/Joint Ice Center, Suitland,
W80-00568 2C

Mapping and Archiving of Canadian Sea Ice Data,
W80-00569 7C

The United States Environmental Satellite Data Archives,
W80-00571 7B

An Arctic Sea Ice Data Set, 1901-1956,
W80-00576 2C

Inadequacies in Archived Sea Ice Data,
W80-00577 2C

NASA Mapping Projects (Summary),
W80-00578 7C

Water Withdrawals in Illinois, 1978,
W80-00722 7C

DATA PROCESSING

An Arctic Sea Ice Data Set, 1901-1956,
W80-00576 2C

Inadequacies in Archived Sea Ice Data,
W80-00577 2C

DATA STORAGE AND RETRIEVAL

Current Methodologies for the Collection and Dissemination of Water Resources Data in the United States,
W80-00474 7A

Archiving and Mapping of Canadian Snow Cover Data,
W80-00574 2C

NASA Mapping Projects (Summary),
W80-00578 7C

DEFORESTATION

Rehabilitation of Catchment Areas in Mountain Regions,
W80-00469 4A

DELAWARE

Summertime Synoptic Variability of the Middle Atlantic Shelf Water/Slope Water Front,
W80-00740 2L

DELAWARE RIVER

Persistence of Chlorine in Cooling Water from Electric Generating Station,
W80-00581 5A

DEMERSAL FISH

Survey of Demersal Fish in Port Phillip Bay for Incidence of Neoplasia,
W80-00680 5A

DENDROCHRONOLOGY

Extension of River Flow Records in Argentina from Long Tree-Ring Chronologies,
W80-00731 2E

DESALINATION

Non Conventional Water Resources: Some Advances in their Development,
W80-00429 3C

On Water Reuse Promotion Measures,
W80-00477 6F

Increasing Available Water Supplies Through Weather Modification and Desalination,
W80-00479 2B

DESERTIFICATION

Note to the United Nations Water Conference on Preparations for the United Nations Conference on Desertification.
W80-00422 2A

DESERTS

Note to the United Nations Water Conference on Preparations for the United Nations Conference on Desertification.
W80-00422 2A

DESIGN

World Bank: An Approach for Selection of Labour Vs. Capital Intensive Technologies for Water Resource Development Projects.
W80-00412 6C

DESIGN CRITERIA

The Design and Evaluation of Institutional Arrangements for Water Planning and Management,
W80-00431 6E

DESMIDS

Phytoplankton in the Fox Chain of Lakes,
W80-00686 5C

DEVELOPING COUNTRIES

Water, Women, and Development,
W80-00416 6A

World Employment Programme: Appropriate Construction Technology for Water Control and Irrigation Works in Developing Countries,
W80-00419 6A

Technical Cooperation Among Developing Countries with Regard to Water Resources Development.
W80-00425 6E

Assessment of Water Resources: Networks, Surveys, Services, and Related Facilities: Present Status and Requirements by 2000.
W80-00426 6A

Report on Community Water Supplies,
W80-00427 5F

Water for the Thousand Millions,
W80-00432 6A

Irrigation Management in Developing Countries: A Suggested Action Programme,
W80-00481 3F

DEVON (ENGLAND)

An Analysis of the Processes of River Bank Erosion,
W80-00612 2J

DEWATERED DREDGED MATERIAL

Best Ways to Dewater Dredged Material,
W80-00733 2G

DEWATERING

Best Ways to Dewater Dredged Material,
W80-00733 2G

DIATOMS

Growth and Competition of the Marine Diatoms Phaeodactylum Tricornutum and Thalassiosira Pseudonana, I. Nutrient Effects,
W80-00515 5C

The Diatomflora of a Small Stream Near Abisko (Swedish Lapland) and Its Annual Periodicity, Judged by Drift and Colonization,
W80-00516 5C

Zinc Uptake in Marine Diatoms,
W80-00669 5A

Unexpected Response to Vitamin B12 of Dominant Centric Diatoms from the Spring Bloom in the Gulf of Maine (Northeast Atlantic Ocean),
W80-00681 5C

DIELDRIN

Electric Fish as a Tool for Water Quality Assessment,
W80-00659 5A

DIETS

The Biochemical Composition of the Larvae of Two Strains of Artemia Salina (L.) Reared on two Different Algal Foods,
W80-00502 5C

DIFFUSION

Absorption of Water by Soil: The Constant Flux Boundary Condition,
W80-00596 2G

Estimates of Vertical Eddy Diffusion Through the Thermocline from Phytoplankton Nitrate Uptake Rates in the Mixed Layer of the Eastern Tropical Pacific,
W80-00630 2L

DIFFUSIVITY

Physical Components of the Diffusivity Coefficient,
W80-00754 2G

DIOXIN

The Response of Coho Salmon and Guppies to 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) in Water,
W80-00651 5A

DIPTERA

The Use of Chironomid Pupal Exuviae in the Surveillance of Sewage Pollution Within a Drainage System,
W80-00794 5A

DISASTER LOANS

Flood Insurance or Disaster Loans: An Economic Evaluation,
W80-00492 6B

DISCHARGE RATES

Dispersion and Impact of Mobile River System Waters in Mobile Bay, Alabama,
W80-00491 2E

DISCHARGE (WATER)

Some Dimensional Considerations in the Unit Hydrograph Theory,
W80-00591 2E

Influence of Turbulence on the Accuracy of Discharge Measurements in Natural Streamflows,
W80-00745 2E

DISINFECTANTS

Toxicity of Fishery Chemicals to the Asiatic Clam, Corbicula Manilensis,
W80-00785 5A

DISPERSANTS

Effects of Kuwait Oils on Feeding Rates of Copepods,
W80-00666 5A

DISPERSION

Foundation Theories of Solute Transport in Porous Media: A Critical Review,
W80-00606 2A

DISSOLVED ORGANIC MATTER

Sources, Transportation and Utilization of Dissolved Organic Matter in Groundwater and Streams,
W80-00530 2F

DISSOLVED OXYGEN

The Survival of Smolts of Salmon Salmo Salar L. at Low Concentrations of Dissolved Oxygen,
W80-00655 5A

Oxygen Depletion and Winterkill Risk in Small Prairie Lakes Under Extended Ice Cover,
W80-00668 5A

The Effects of Pollution-Induced Oxygen Deficiency on the Benthos in Elefsis Bay, Greece,
W80-00690 5C

DISSOLVED SOLIDS
Sources, Transportation and Utilization of Dissolved Organic Matter in Groundwater and Streams,
W80-00530 2F

DISTRIBUTION
The Diatomflora of a Small Stream Near Abisko (Swedish Lapland) and Its Annual Periodicity, Judged by Drift and Colonization,
W80-00516 5C

DISTRIBUTION PATTERNS
Phytoplankton in the Fox Chain of Lakes,
W80-00686 5C

DIVERSITY INDICES
The Effects of Pollution-Induced Oxygen Deficiency on the Benthos in Elefsis Bay, Greece,
W80-00690 5C

DOCUMENTATION
Snow and Ice Data Sets for Climate and Water Resource Studies with Particular Reference to North America,
W80-00567 2C

DOLOMITE
Contamination Potential in the Silurian Dolomite Aquifer, Eastern Wisconsin,
W80-00757 5B

DOMESTIC WASTEWATER
Long-Term Effects of Land Application of Domestic Wastewater: Vineland, New Jersey, Rapid Infiltration Site,
W80-00529 5E

DOMESTIC WATER
Water for Domestic Use in Rural Areas - Thailand,
W80-00448 6D

Water Usage Profile-Fort Carson Co.,
W80-00494 6D

DOMINANT ORGANISMS
Responses of Marine Fouling Communities to Sewage Abatement in Kaneohe Bay, Oahu, Hawaii,
W80-00791 5B

DOUBLOON BRANCH (LA)
Flood Plain Information: Bayou Bonfouca-Bayou Vincent W-14 Main Diversion Canal Doubloon Branch-French Branch, Slidell, Louisiana and Vicinity,
W80-00536 2E

DOUBS RIVER (FRANCE)
Effects of the Construction of a Broad Waterway on the Water Quality of the Doubs (Effets de la Canalisation a Grand Gabarit sur la Qualite des Eaux du Doubs),
W80-00704 5B

DRAINAGE
Floral and Faunal Changes in Lowland Hardwood Forests in Missouri Resulting from Channelization, Drainage, and Impoundment,
W80-00528 6G

A Finite-Element Distributed Catchment Model, II. Application to Real Catchments,
W80-00749 2E

A Galerkin in Time, Linearized Finite Element Model of 2-Dimensional Unsaturated Porous Media Drainage,
W80-00753 2G

DRAINAGE AREA
Drainage Areas of the Twelvepole Creek Basin, West Virginia, Big Sandy River Basin, West Virginia, Tug Fork Basin, Virginia, Kentucky, West Virginia,
W80-00765 7C

DRAINAGE SYSTEMS
Drainage Network Power,
W80-00725 8E

DRAWDOWN
Ground-Water Conditions and Potential for Artificial Recharge in Lucerne Valley, San Bernardino County, California,
W80-00763 4B

DREDGED MATERIAL
Best Ways to Dewater Dredged Material,
W80-00733 2G

DREDGING
The Impact of Dredged Holes on Oxygen Demand in the Lower Bay, New York Harbor,
W80-00694 4C

Best Ways to Dewater Dredged Material,
W80-00733 2G

DROUGHTS
The Response of Groundwater Systems to Drought,
W80-00462 4B

DRY SOIL
Predicting Hysteretic Effects in Evaporation From Bare Soil,
W80-00732 2D

DYE RELEASES
Estimating the Gas and Dye Quantities for Modified Tracer Technique Measurements of Stream Reaeration Coefficients,
W80-00773 5B

DYNAMIC PROGRAMMING
Optimal Management of a Multireservoir Water Supply System,
W80-00583 4A

EASEMENTS
Federal Tax Incentives for Private Environmental Planning,
W80-00496 6E

EAST FLOWER GARDEN BANK
Chemical Aspects of a Brine Pool at the East Flower Garden Bank, Northwestern Gulf of Mexico,
W80-00626 2K

EASTERN WISCONSIN
Contamination Potential in the Silurian Dolomite Aquifer, Eastern Wisconsin,
W80-00757 5B

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC
Report of the ESCAP Regional Preparatory Meeting for the United Nations Water Conference.
W80-00406 6A

ECONOMIC COMMISSION FOR AFRICA
Economic Commission for Africa, Regional Report,
W80-00409 6A

ECONOMIC COMMISSION FOR EUROPE
Economic Commission for Europe. Regional Report,
W80-00408 6A

ECONOMIC COMMISSION FOR LATIN AMERICA
Report of the Regional Preparatory Meeting of the Countries of Latin America and the Caribbean for the United Nations Water Conference,
W80-00407 6A

ECONOMIC COMMISSION FOR WESTERN ASIA
Report of the Economic Commission for Western Asia Regional Preparatory Meeting.
W80-00410 6A

ECONOMIC DEVELOPMENT
Water, Women, and Development,
W80-00416 6A

ECONOMIC PARAMETERS
Economic Parameters,
W80-00563 6B

ECONOMICS
World Bank: Pricing as a Means of Controlling the Use of Water Resources.
W80-00411 6C

Restriction of Supply and Risk in Water Supply Systems,
W80-00442 6C

On Role of Administrative, Economic and Technological Measures in Protection of Surface and Subterranean Water Against Contamination and Depletion,
W80-00465 6E

ECONOMIES
Principles and Methods for the Provision of Economic Incentives in Water Supply and Waste Water Disposal Systems.
W80-00436 6B

ECOSYSTEMS
Environmental Issues in River Basin Development,
W80-00433 2A

The Environmental Impacts of the Aswan High Dam,
W80-00446 5C

Environmental Assessment of an Active Oil Field in the Northwestern Gulf of Mexico 1977-1978. Volume III: Chemical and Physical Investigations.
W80-00692 5C

Adaptation of the EPAECO Model to a Lake in Central Finland,
W80-00710 2L

A Mathematical Ecosystem Model Applicable to Shallow Water Bodies,
W80-00711 2L

New Aspects of the Consideration of Feedback Mechanisms in an Ecological Model of the Pelagic Zone,
W80-00715 2H

EDUCATION
Algal Biochemical Tricks and Classification,
W80-00512 5C

EELGRASS
Uptake of Cadmium by the Eelgrass Zostera Marina,
W80-00789 5A

EFFECTS
The Effects of pH on the Aluminum, Iron and Calcium Phosphate Fractions of Lake Sediments,
W80-00588 2J

Microbial Effects on Soil Erodibility,
W80-00594 2J

EFFLUENTS
Long-Term Effects of Land Application of Domestic Wastewater: Vineland, New Jersey, Rapid Infiltration Site,
W80-00529 5E

Environmental Pollution Control Alternatives: Municipal Wastewater,
W80-00544 5D

EGYPT
Application of Geoscientific Knowledge to Evaluation of Land and Water Resources in Some Desert Areas of Egypt,
W80-00639 6B

Water Resources and Land Reclamation in Egypt,
W80-00643 6B

ELECTRIC FISH
Electric Fish as a Tool for Water Quality Assessment,
W80-00659 5A

ELECTRIC POWERPLANTS
Integration of Thermal and Food Processing Residuals into a System for Commercial Culture of Freshwater Shrimp. (Power Plant Waste Heat Utilization in Aquaculture)., Volume II,
W80-00497 3C

Long-Term Availability of Water Resources for Energy Development in the Central United States,
W80-00499 6D

ELECTRICAL CONDUCTANCE
Measurement of Apparent Electrical Conductivity of Soils by an Electromagnetic Induction Probe to Aid Salinity Surveys,
W80-00750 2G

Inexpensive Four-Electrode Probe for Monitoring Soil Salinity,
W80-00751 2G

A Compact, Low-Cost Circuit for Reading Four-Electrode Salinity Sensors,
W80-00752 2G

EMPLOYMENT
World Bank: An Approach for Selection of Labour Vs. Capital Intensive Technologies for Water Resource Development Projects.
W80-00412 6C

World Employment Programme: Appropriate Construction Technology for Water Control and Irrigation Works in Developing Countries,
W80-00419 6A

ENERGY
Long-Term Availability of Water Resources for Energy Development in the Central United States,
W80-00499 6D

Economic Parameters,
W80-00563 6B

ENERGY BUDGET
Experimental and Field Studies on Ecological Energetics of Asellus Aquaticus L. (Isopoda). Energy Budget of a Population in the Littoral Zone of Powsinskie Lake,
W80-00507 5C

ENERGY DISSIPATION
Sand Bed Friction Factors for Oscillatory Flows,
W80-00734 2L

ENGINEERING
CMEA Glossary on Water Management,
W80-00437 6A

ENGINEERING PARAMETERS
Engineering and Cost Parameters,
W80-00564 6B

ENTEROBACTER
Effects of Bottom Sediments on the Survival of Enterobacter Aerogenes in Seawater,
W80-00662 5A

ENVIRONMENTAL EFFECTS
Environmental Issues in River Basin Development,
W80-00433 2A

The Environmental Impacts of the Aswan High Dam,
W80-00446 5C

Rehabilitation of Catchment Areas in Mountain Regions,
W80-00469 4A

Reduction of Aquatic Vegetation Following the Colonization of a Northern Swedish Lake by the Muskrat, Ondatra Zibethica,
W80-00513 5C

An Assessment of the Effects of Bathymetric Changes Associated with Sand and Gravel Mining on Tidal Circulation in the Lower Bay of New York Harbor,
W80-00693 2J

ENVIRONMENTAL ISOTOPE TECHNIQUES
Isotope Hydrology.
W80-00421 4A

ENVIRONMENTAL REGULATION
Integrated Planning and Water Quality Management: The Federal Water Pollution Control Act Amendments of 1972 and Coastal Zone Management,
W80-00527 6E

EQUATIONS
On the Choice of Boundary Conditions for One-Dimensional Models of Estuarine Water Quality,
W80-00706 2L

EROSION
Influence of Surface Roughness and Clod Size and Stability on Soil and Water Losses,
W80-00593 2J

An Analysis of the Processes of River Bank Erosion,
W80-00612 2J

EROSION CONTROL
Urban Stormwater Pollution: An Investigation of the Problem and Its Control,
W80-00525 5B

EROSION PROCESSES
An Analysis of the Processes of River Bank Erosion,
W80-00612 2J

ESTATE TAXES
Federal Tax Incentives for Private Environmental Planning,
W80-00496 6E

ESTIMATING
Engineering and Cost Parameters,
W80-00564 6B

Statistical Terminology: Definitions and Interpretation for Flood Peak Estimation,
W80-00729 2E

ESTUARIES
Water Quality Investigation of Estuaries of Georgia, 1976,
W80-00553 2L

The Production and Fate of Phytoplankton Size Fractions in the Plume of the Hudson River, New York Bight,
W80-00628 2L

Upwelling and Estuary Flushing,
W80-00632 2L

On the Choice of Boundary Conditions for One-Dimensional Models of Estuarine Water Quality,
W80-00706 2L

Evaluation of a Digital Model for Estuarine Water Quality Simulation in Waste Allocation Studies,
W80-00761 5B

ESTUARINE ENVIRONMENT
Water Quality Investigation of Estuaries of Georgia, 1976,
W80-00553 2L

EUROPE
Economic Commission for Europe. Regional Report,
W80-00408 6A

An Analysis of the Processes of River Bank Erosion,
W80-00612 2J

Low-Frequency Sea Level and Current Fluctuations Along the Coast of Northwest Italy,
W80-00742 2L

EUTROPHICATION
Eutrophication and Rehabilitation of Surface Waters,
W80-00417 5C

The Source of Muddy Odor in Bream (Abramis Brama) from the Porvoo Sea Area (Gulf of Finland),
W80-00661 5A

A Simple Eutrophication Model for the Bay of Keszthely, Lake Balaton,
W80-00712 2L

Modelling of the Eutrophication Process in Lakes and Reservoirs,
W80-00718 2H

Effects of Artificial Eutrophication on the Metabolism of the Japanese Oyster Crassostrea Gigas,
W80-00792 5B

EVALUATION
The Design and Evaluation of Institutional Arrangements for Water Planning and Management,
W80-00431 6E

A Model for Simulating Lake Ecosystems,
W80-00521 5C

EVALUATION MATRIX
Instream Flow Strategies for Washington,
W80-00531 6E

Instream Flow Strategies for California,
W80-00532 6E

EVAPORATION
A Wind Tunnel Investigation of the Rate of Evaporation of Large Water Drops Falling at Terminal Velocity in Air,
W80-00602 2B

Heat and Mass Exchange Coefficients for Open Water Surfaces,
W80-00714 2D

Predicting Hysteretic Effects in Evaporation From Bare Soil,
W80-00732 2D

EVAPORATION CONTROL
Non Conventional Water Resources: Some Advances in their Development,
W80-00429 3C

EVAPOTRANSPIRATION
Evaporation from Vegetation in Landscapes Developing Secondary Salinity Using the Ventilated-Chamber Technique, I. Comparative Transpiration from Juvenile Eucalyptus Above Saline Groundwater Seeps,
W80-00755 2I

EVERGLADES NATIONAL PARK
Polychlorinated Biphenyls and Chlorinated Pesticides in Soils of the Everglades National Park and Adjacent Agricultural Areas,
W80-00618 5A

FARM MANAGEMENT
Water, Food, and Fiber,
W80-00455 3F

Conservation Bench Terraces for Rice in a Subhumid Climate,
W80-00595 3F

FARM WASTES
Physical Condition of a Davidson Clay Loam after Five Years of Heavy Poultry Manure Applications,
W80-00620 2G

FEDERAL WATER POLLUTION CONTROL ACT
Implementation Strategies for Public Law 92-500, Section 208,
W80-00524 6E

Integration of Residual Waste Management with Water Quality Management,
W80-00526 6E

Integrated Planning and Water Quality Management: The Federal Water Pollution Control Act Amendments of 1972 and Coastal Zone Management,
W80-00527 6E

FEEDING RATES
Effects of Kuwait Oils on Feeding Rates of Copepods,
W80-00666 5A

FERTILIZATION
The Influence of Fertilization on Phytoplankton in Ponds with Varied Development of Biocoenose,
W80-00509 5C

FERTILIZERS
The Effect of Intense Fertilization on Migration of Nitrogen Compounds in Soil,
W80-00508 5C

FIBERS (PLANT)
Water, Food, and Fiber,
W80-00455 3F

FINANCING
Drinking Water Supply - A Field for UNICEF Assistance.
W80-00420 5D

Water for Domestic Use in Rural Areas - Thailand,
W80-00448 6D

Swedish Policy for Water Quality Protection,
W80-00454 6E

Water Resources and the Nation's Water Supply: Issues and Concerns,
W80-00542 6B

FINITE DIFFERENCE METHOD
Evaluation of a Digital Model for Estuarine Water Quality Simulation in Waste Allocation Studies,
W80-00761 5B

FINITE ELEMENT ANALYSIS
Modeling Groundwater Flow Fields Containing Point Singularities: A Technique for Singularity Removal,
W80-00609 2F

A Galerkin in Time, Linearized Finite Element Model of 2-Dimensional Unsaturated Porous Media Drainage,
W80-00753 2G

FINLAND
Finnish Experiences in Water-Resources Planning and Management Policy,
W80-00451 6A

Experiences in Joint Administration of Border Watercourses,
W80-00452 6A

Adaptation of the EPAECO Model to a Lake in Central Finland,
W80-00710 2L

FISH
Can Planktovorous Fish Keep in Check Planktonic Crustacean Populations. A Test of Size-Efficiency Hypothesis in Typical Polish Lakes,
W80-00505 5C

Water Quality in Channel Catfish Production Ponds,
W80-00619 5A

FISH AND WILDLIFE
Instream Flow Strategies for Washington,
W80-00531 6E

Instream Flow Strategies for California,
W80-00532 6E

Impact Assessment of Water Resource Development Activities: A Dual Matrix Approach,
W80-00550 6B

FISH BEHAVIOR
The Temperature Preference of the Three-Spined Stickleback, Gasterosteus Aculeatus L. (Pisces), Collected at Different Seasons,
W80-00797 5A

FISH DISEASE
Hepatomas in Atlantic Tomcod Microgadus Tomcod (Walbaum) Collected in the Hudson River Estuary in New York,
W80-00675 5B

FISH DISEASES
Nephrocalcinosis in Rainbow Trout Salmo Gairdneri Richardson; The Effect of Exposure to Elevated CO2 Concentrations,
W80-00674 5A

Survey of Demersal Fish in Port Phillip Bay for Incidence of Neoplasia,
W80-00680 5A

The Role of Melano-Macrophage Centres in Iron Storage in Normal and Diseased Fish,
W80-00683 5A

FISH PHYSIOLOGY
Physiological Adaptations of Salmonid Fishes (Salmo clarki henshawi, Salmo gairdneri, and Oncorhynchus kisutch) to Alkaline Saline Water and Their Toxic Effects,
W80-00488 2H

Thermal Shock Resistance of Spot (Leiostomus Xanthurus) After Acclimation to Constant or Cycling Temperature,
W80-00652 5C

Sensitivity of Alaskan Freshwater and Anadromous Fishes to Prudhoe Bay Crude Oil and Benzene,
W80-00660 5A

Effects of Oral Administration of Cadmium on Fish-V Effects on Calcium and Inorganic Phosphorus Excretion in the Carp,
W80-00663 5A

The Role of Melano-Macrophage Centres in Iron Storage in Normal and Diseased Fish,
W80-00683 5A

Carbonic Acid Anesthesia for Aquatic Organisms,
W80-00786 5A

FISH POPULATIONS
A Seasonal Survey of Fish Populations in the Lower Medway Estuary, Kent, Based on Power Station Screen Samples,
W80-00650 5C

FISHKILL
Some Observations on Pollutants of Velsao Bay (GOA),
W80-00688 5A

FLAGELLATES
Phytoplankton in the Fox Chain of Lakes,
W80-00686 5C

FLAGFISH
Chronic Toxicity of Vanadium to Flagfish,
W80-00795 5A

FLOOD CONTROL
Rational Methods of Flood Control Planning in River Basin Development,
W80-00435 6A

The Long-Term National Programme for River Basin Development, Basis of the Water Management Policy in Romania,
W80-00450 6A

The United States Experience in Flood Plain Management,
W80-00459 6F

FLOOD DAMAGE
Rational Methods of Flood Control Planning in River Basin Development,
W80-00435 6A

Floods of December 1978 in Kentucky,
W80-00758 2E

FLOOD DATA
Flood Hazard Analyses, Little Ossipee River, Towns of Acton, Newfield and Shapleigh, Maine, York County.
W80-00535 2E

Special Flood Hazard Information Report: Tygart River, Taylor County, West Virginia,
W80-00538 2E

Flood Plain Information: Baton Rouge, Louisiana, No 4, Hurricane Creek, Monte Sano Bayou and Tributaries,
W80-00541 2E

Floods of December 1978 in Kentucky,
W80-00758 2E

FLOOD DISCHARGE
Effects of Urbanization on the Magnitude and Frequency of Floods in Northeastern Illinois,
W80-00769 4C

FLOOD FLOW
Note on the Distribution of Flood Maxima for Random Sample Size,
W80-00611 2E

FLOOD FORECASTING
Special Flood Hazard Information Report: Tygart River, Taylor County, West Virginia,
W80-00538 2E

A Dimensionally Homogeneous and Statistically Optimal Model for Predicting Mean Annual Flood,
W80-00747 2E

Flood Profiles Along the Cedar River, King County, Washington,
W80-00760 2E

Technique for Estimating the Magnitude and Frequency of Floods in St. Louis County, Missouri,
W80-00762 2E

FLOOD FREQUENCY
Special Flood Hazard Information Report: Tygart River, Taylor County, West Virginia,
W80-00538 2E

Flood Profiles Along the Cedar River, King County, Washington,
W80-00760 2E

Effects of Urbanization on the Magnitude and Frequency of Floods in Northeastern Illinois,
W80-00769 4C

FLOOD INSURANCE
Flood Insurance or Disaster Loans: An Economic Evaluation,
W80-00492 6B

FLOOD MAXIMA
Note on the Distribution of Flood Maxima for Random Sample Size,
W80-00611 2E

FLOOD PEAK
Statistical Terminology: Definitions and Interpretation for Flood Peak Estimation,
W80-00729 2E

FLOOD PLAINS
Rational Methods of Flood Control Planning in River Basin Development,
W80-00435 6A

The United States Experience in Flood Plain Management,
W80-00459 6F

Flood Plain Information: Baton Rouge, Louisiana, No 4, Hurricane Creek, Monte Sano Bayou and Tributaries,
W80-00541 2E

FLOOD PROFILES
Flood Plain Information: Bayou Bonfouca-Bayou Vincent W-14 Main Diversion Canal Doubloon Branch-French Branch, Slidell, Louisiana and Vicinity,
W80-00536 2E

Special Flood Hazard Information Report: Tygart River, Taylor County, West Virginia,
W80-00538 2E

Flood Plain Information: Baton Rouge, Louisiana, No. 5, Cypress Bayou and Tributaries,
W80-00540 2E

Flood Plain Information: Baton Rouge, Louisiana, No 4, Hurricane Creek, Monte Sano Bayou and Tributaries,
W80-00541 2E

Flood Profiles Along the Cedar River, King County, Washington,
W80-00760 2E

FLOOD ROUTING
A Storage Routing Model Based on Catchment Geomorphology,
W80-00590 2E

FLOOD STAGES
Flood Hazard Analyses, Little Ossipee River, Towns of Acton, Newfield and Shapleigh, Maine, York County.
W80-00535 2E

Flood Plain Information: Bayou Bonfouca-Bayou Vincent W-14 Main Diversion Canal Doubloon Branch-French Branch, Slidell, Louisiana and Vicinity,
W80-00536 2E

FLOODING
Flood Plain Information: Ohio River, Hancock County, Kentucky,
W80-00537 2E

Flood Plain Information: Ohio River, Boone County, Kentucky,
W80-00539 2E

Flood Plain Information: Baton Rouge, Louisiana, No. 5, Cypress Bayou and Tributaries,
W80-00540 2E

Flood Plain Information: Baton Rouge, Louisiana, No 4, Hurricane Creek, Monte Sano Bayou and Tributaries,
W80-00541 2E

Guidelines for Urban Development in Louisiana's Coastal Wetlands,
W80-00547 4C

FLOODPLAINS
Environmental Observations of a Riparian Ecosystem During Flood Season,
W80-00691 2E

FLOODS
Flood Hazard Analyses, Little Ossipee River, Towns of Acton, Newfield and Shapleigh, Maine, York County.
W80-00535 2E

Flood Plain Information: Bayou Bonfouca-Bayou Vincent W-14 Main Diversion Canal Doubloon Branch-French Branch, Slidell, Louisiana and Vicinity,
W80-00536 2E

Note on the Distribution of Flood Maxima for Random Sample Size,
W80-00611 2E

A Dimensionally Homogeneous and Statistically Optimal Model for Predicting Mean Annual Flood,
W80-00747 2E

Floods of December 1978 in Kentucky,
W80-00758 2E

FLORIDA
Polychlorinated Biphenyls and Chlorinated Pesticides in Soils of the Everglades National Park and Adjacent Agricultural Areas,
W80-00618 5A

Silver Concentration in Rainwater from Seeded and Nonseeded Florida Cumuli: 1973-1975 Results,
W80-00736 2B

FLOW RATES
Statistical Summaries of Arizona Streamflow Data,
W80-00771 2E

FLOW RESISTANCE
Dividing-Flow Manifolds with Square-Edged Laterals,
W80-00582 8B

FLOW SEPARATION
Dividing-Flow Manifolds with Square-Edged Laterals,
W80-00582 8B

FOOD WEBS
Mixing an Enclosed, 1300 Cubic Meter Water Column: Effects on the Planktonic Food Web,
W80-00672 5A

FORECASTING
Long-Term Planning of Water Management,
W80-00434 6A

Hydrological Forecasting for Operational Planning and Management of Water Resources,
W80-00467 2E

Data Sources and Sea Ice Products of Fleet Weather Facility/Joint Ice Center, Suitland,
W80-00568 2C

A Comparative Analysis of Multi-Source Water Supply Data for Pima County, Arizona,
W80-00644 6D

Projected Water Use and Water Budget Calculations for Pima County, Arizona,
W80-00647 6B

FOREST WATERSHEDS
Streamflow Generation in a Forested Watershed, New Zealand,
W80-00724 2E

FORESTS
Floral and Faunal Changes in Lowland Hardwood Forests in Missouri Resulting from Channelization, Drainage, and Impoundment,
W80-00528 6G

FORT CARSON
Water Usage Profile-Fort Carson Co.,
W80-00494 6D

FORT LAUDERDALE (FLA)
Stormwater-Runoff Data for a Commercial Area, Broward County, Florida,
W80-00772 4C

FOULING
Water Quality Investigation of Estuaries of Georgia, 1976,
W80-00553 2L

Responses of Marine Fouling Communities to Sewage Abatement in Kaneohe Bay, Oahu, Hawaii,
W80-00791 5B

FRANCE
Effects of the Construction of a Broad Waterway on the Water Quality of the Doubs (Effets de la Canalisation a Grand Gabarit sur la Qualite des Eaux du Doubs),
W80-00704 5B

FRENCH BRANCH (LA)
Flood Plain Information: Bayou Bonfouca-Bayou Vincent W-14 Main Diversion Canal Doubloon Branch-French Branch, Slidell, Louisiana and Vicinity,
W80-00536 2E

FRESHWATER
Evaluation of an Enzymatic Method for Orthophosphate Determination in Freshwaters,
W80-00625 5A

FRONTS (OCEANIC)
Shelf Sea Fronts' Adjustments Revealed by Satellite IR Imagery,
W80-00603 2L

Summertime Synoptic Variability of the Middle Atlantic Shelf Water/Slope Water Front,
W80-00740 2L

FURBEARERS
The Effects of Channelization on Furbearers and Furbearer Habitat,
W80-00800 5C

GADSDEN COUNTY (FLA)
Water-Quality Assessment of Runoff from a Rural Highway Bridge Near Tallahassee, Florida,
W80-00767 5B

GAGING STATIONS
Statistical Summaries of Arizona Streamflow Data,
W80-00771 2E

GALERKIN METHOD
A Galerkin in Time, Linearized Finite Element Model of 2-Dimensional Unsaturated Porous Media Drainage,
W80-00753 2G

GEOCHEMISTRY
Application of Geoscientific Knowledge to Evaluation of Land and Water Resources in Some Desert Areas of Egypt,
W80-00639 6B

GEOHYDROLOGIC UNITS
Application of Geoscientific Knowledge to Evaluation of Land and Water Resources in Some Desert Areas of Egypt,
W80-00639 6B

GEOMORPHOLOGY
Geomorphic Study of Upper Mississippi River,
W80-00585 2E

GEORGIA
Water Quality Investigation of Estuaries of Georgia, 1976,
W80-00553 2L

GEOSMIN
The Source of Muddy Odor in Bream (Abramis Brama) from the Porvoo Sea Area (Gulf of Finland),
W80-00661 5A

GERMANY
The Biocenotic Model,
W80-00707 5B

GLACIAL AQUIFERS
Ground Water in Dale Valley, New York,
W80-00768 4B

GLACIOLOGY
Glaciological Data: Workshop on Snow Cover and Sea Ice Data.
W80-00566 2C

Snow and Ice Data Sets for Climate and Water Resource Studies with Particular Reference to North America,
W80-00567 2C

GLOSSARIES
CMEA Glossary on Water Management,
W80-00437 6A

GLYCERIA
Effects of Treated Effluent on a Natural Marsh,
W80-00677 5B

GRADIENTS
On the Growth of Instabilities in Groundwater Due to Temperature and Salinity Gradients,
W80-00605 2F

GRAPHICAL ANALYSIS
Tillamook Bay Entrance Refraction Study, Tillamook, Oregon,
W80-00501 8A

GREAT LAKES
Boundary Waters Management,
W80-00480 6E

Nutrient Exchange Between Volume Elements of Large Lakes,
W80-00716 2H

GREATER SCAUP DUCK
Trace Metals in Seaducks of the Fraser River Delta Intertidal Area, British Columbia,
W80-00657 5A

GROUNDWATER
Isotope Hydrology.
W80-00421 4A

Assessment of Water Resources: Networks, Surveys, Services, and Related Facilities: Present Status and Requirements by 2000
W80-00426 6A

Finnish Experiences in Water-Resources Planning and Management Policy,
W80-00451 6A

The Response of Groundwater Systems to Drought,
W80-00462 4B

Methods of Ground-Water Protection from Pollution,
W80-00463 4B

Nature and Properties of Water in Montmorillonite-Water Systems,
W80-00597 2G

Natural Control of the Chemical Composition of Water During the Infiltration Process--First Results (Acquisition de la Composition Chimique de L'Eau au Cours de L'Infiltration en Milieu Naturel--Premiers Resultats D'Une Etude Experimentale),
W80-00719 5B

Computation of the Advancement of Groundwater Pollution Due to Petroleum Products Originating from a Known Source of Contamination (Le Calcul de la Propagation de la Pollution des Eaux Souterraines par des Materiaux Huileux, Provenants D'une Source de la Pollution Connue),
W80-00720 5B

The Application of a Digital Model for Evaluating the Bedrock Water Resources of the Maumee River Basin, Northwestern Ohio,
W80-00726 2F

Evaporation from Vegetation in Landscapes Developing Secondary Salinity Using the Ventilated-Chamber Technique, I. Comparative Transpiration from Juvenile Eucalyptus Above Saline Groundwater Seeps,
W80-00755 2I

Contamination Potential in the Silurian Dolomite Aquifer, Eastern Wisconsin,
W80-00757 5B

Water Resources Data for Wisconsin, Water Year 1978.
W80-00777 7C

Water Resources Data for South Carolina, Water Year 1978.
W80-00778 7C

Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 1. Hawaii.
W80-00779 7C

Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 2. Trust Territory of the Pacific Islands, Guam, American Samoa, and Northern Mariana Islands,
W80-00780 7C

GROUNDWATER AVAILABILITY
Water Resources and Land Reclamation in Egypt,
W80-00643 6B

Digital Model of the Hollister Valley Ground-Water Basin, San Benito County, California,
W80-00756 6A

Ground-Water Appraisal for the Community of Kiryas Joel, Orange County, New York,
W80-00759 2A

A Preliminary Appraisal of the Impact of Agriculture on Ground-Water Availability in Southwest Georgia,
W80-00770 4B

GROUNDWATER CONTAMINATION POTENTIAL
Contamination Potential in the Silurian Dolomite Aquifer, Eastern Wisconsin,
W80-00757 5B

GROUNDWATER MANAGEMENT
Ground-Water Management Techniques for the Control of Salt-Water Encroachment in Gulf-Coast Aquifers, A Summary Report,
W80-00490 2F

GROUNDWATER MOVEMENT
Sources, Transportation and Utilization of Dissolved Organic Matter in Groundwater and Streams,
W80-00530 2F

On the Growth of Instabilities in Groundwater Due to Temperature and Salinity Gradients,
W80-00605 2F

Effects of In-Transit Water on Groundwater Mounds Beneath Circular and Rectangular Recharge Areas,
W80-00610 2F

GROUNDWATER POLLUTION
Potential Ground Water Pollution from Sewage Sludge Application on Agricultural Land,
W80-00489 5G

Long-Term Effects of Land Application of Domestic Wastewater: Vineland, New Jersey, Rapid Infiltration Site,
W80-00529 5E

GROUNDWATER POTENTIAL
Ground-Water Appraisal for the Community of Kiryas Joel, Orange County, New York,
W80-00759 2A

GROUNDWATER RECHARGE
The Main Directions of Hydrogeological Investigations for the Substantiation of Artificial Recharge,
W80-00468 2A

Ground Water Replenishment from Riverflow,
W80-00604 2F

Effects of In-Transit Water on Groundwater Mounds Beneath Circular and Rectangular Recharge Areas,
W80-00610 2F

A Preliminary Appraisal of the Impact of Agriculture on Ground-Water Availability in Southwest Georgia,
W80-00770 4B

GROUNDWATER RESOURCES
Digital Model of the Hollister Valley Ground-Water Basin, San Benito County, California,
W80-00756 6A

Ground-Water Appraisal for the Community of Kiryas Joel, Orange County, New York,
W80-00759 2A

Ground-Water Conditions and Potential for Artificial Recharge in Lucerne Valley, San Bernardino County, California,
W80-00763 4B

Annual Water-Resources Review, White Sands Missile Range, New Mexico, 1978,
W80-00764 4D

GROWTH RATE
The Influence of Fertilization on Phytoplankton in Ponds with Varied Development of Biocoenose,
W80-00509 5C

GROWTH RATES
The Biochemical Composition of the Larvae of Two Strains of Artemia Salina (L.) Reared on two Different Algal Foods,
W80-00502 5C

Growth Rates and Temperature Selection of Bluegill, Lepomis Macrochirus,
W80-00654 5C

The Effect of Cadmium and Lead on the Growth of Two Species of Marine Phytoplankton with Particular Reference to the Development of Tolerance,
W80-00676 5A

Unexpected Response to Vitamin B12 of Dominant Centric Diatoms from the Spring Bloom in the Gulf of Maine (Northeast Atlantic Ocean),
W80-00681 5C

The Effect of Zinc on the Increase in Length of Five Species of Intertidal Fucales,
W80-00682 5B

A Morphometric Study of Lead and Copper Effects on Diatoma Tenue Var. Elongatum (Bacillariophyta),
W80-00782 5A

Interactive Effects of Salinity, Temperature and Polycyclic Aromatic Hydrocarbons on the Survival and Development Rate of Larvae of the Mud Crab Rhithropanopeus Harrisii,
W80-00790 5A

GROWTH STAGES
Sensitivity of Alaskan Freshwater and Anadromous Fishes to Prudhoe Bay Crude Oil and Benzene,
W80-00660 5A

GULF OF GUINEA
On the Generation of the Seasonal Coastal Upwelling in the Gulf of Guinea,
W80-00608 2L

The Use of the Salinity Maximum of the Equatorial Undercurrent for Estimating Nutrient Enrichment and Primary Production in the Gulf of Guinea,
W80-00781 5C

GULF OF MEXICO
Chemical Aspects of a Brine Pool at the East Flower Garden Bank, Northwestern Gulf of Mexico,
W80-00626 2K

GUPPIES
The Response of Coho Salmon and Guppies to 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) in Water,
W80-00651 5A

GYRE
Laboratory Simulation of the Gyre in the Alboran Sea,
W80-00743 2L

HABITATS
The Effects of Channelization on Furbearers and Furbearer Habitat,
W80-00800 5C

HANCOCK COUNTY (KY)
Flood Plain Information: Ohio River, Hancock County, Kentucky,
W80-00537 2E

HAWAII
Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 1. Hawaii.
W80-00779 7C

HEADWATERS
Rehabilitation of Catchment Areas in Mountain Regions,
W80-00469 4A

HEAT BALANCE
Heat and Mass Exchange Coefficients for Open Water Surfaces,
W80-00714 2D

HEAT RESISTANCE
Thermal Shock Resistance of Spot (Leiostomus Xanthurus) After Acclimation to Constant or Cycling Temperature,
W80-00652 5C

HEATED WATER
Integration of Thermal and Food Processing Residuals into a System for Commercial Culture of Freshwater Shrimp. (Power Plant Waste Heat Utilization in Aquaculture)., Volume II,
W80-00497 3C

HEAVY METALS
Study of Metal Contents of Elasmobranch Fishes: Part I-Metal Concentration in the Muscle Tissues of a Dogfish, Squalus Mitsukurii,
W80-00685 5A

Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

HERBICIDES
Efficacy, Uptake and Distribution of Different Herbicides in the Water Hyacinth,
W80-00519 5C

HISTORIC FLOODS
Flood Hazard Analyses, Little Ossipee River, Towns of Acton, Newfield and Shapleigh, Maine, York County.
W80-00535 2E

HISTORY
Water USA: 1776-1976,
W80-00486 6E

HOLLISTER VALLEY
Digital Model of the Hollister Valley Ground-Water Basin, San Benito County, California,
W80-00756 6A

HUMAN RIGHTS
The World's Water in a Human Perspective.
W80-00453 6A

HUNGARY
Environmental Aspects of Pollution Control in Hungary,
W80-00441 6A

An Effort for Modelling the Transport of Micropollutants in Rivers,
W80-00702 5B

A Simple Eutrophication Model for the Bay of Keszthely, Lake Balaton,
W80-00712 2L

HURRICANE CREEK (LA)
Flood Plain Information: Baton Rouge, Louisiana, No 4, Hurricane Creek, Monte Sano Bayou and Tributaries,
W80-00541 2E

HURRICANES
Flood Plain Information: Bayou Bonfouca-Bayou Vincent W-14 Main Diversion Canal Doubloon Branch-French Branch, Slidell, Louisiana and Vicinity,
W80-00536 2E

HYDRAULIC CONDUCTIVITY
A Modified Permeameter for Measuring Hydraulic Conductivity of Soils,
W80-00614 2G

HYDRAULIC ENGINEERING
The Projects for the Increase of the Nile Yield with Special Reference to Jonglei Project,
W80-00447 4A

HYDRAULIC MODELS
Dye-Vector Flow Visualization--Cooling Water Model,
W80-00586 8B

Laboratory Simulation of the Gyre in the Alboran Sea,
W80-00743 2L

HYDRAULICS
Dividing-Flow Manifolds with Square-Edged Laterals,
W80-00582 8B

HYDRODYNAMICS
Modeling Groundwater Flow Fields Containing Point Singularities: A Technique for Singularity Removal,
W80-00609 2F

HYDROELECTRIC POWER
Computerized Optimization of Water Releases from Reservoirs,
W80-00445 4A

HYDROELECTRICITY
Planning Status Report, Water Resources Appraisals for Hydroelectric Licensing: Lower Arkansas River Basin-Arkansas, Colorado, Kansas, New Mexico, Oklahoma and Texas,
W80-00533 6D

HYDROGEN ION CONCENTRATION
The Effects of pH on the Aluminum, Iron and Calcium Phosphate Fractions of Lake Sediments,
W80-00588 2J

Detailed Structure of pH in Hydrometeors,
W80-00616 2K

HYDROGEOLOGY
Methods of Ground-Water Protection from Pollution,
W80-00463 4B

HYDROGRAPH ANALYSIS
Use of Water Quality Variables for Estimation of Water Quantity Characteristics,
W80-00709 2A

HYDROGRAPHS
Determination of Peak Discharge from Rainfall Data for Urbanized Basins, Wichita, Kansas,
W80-00774 6A

HYDROGRAPHY
Application of Geoscientific Knowledge to Evaluation of Land and Water Resources in Some Desert Areas of Egypt,
W80-00639 6B

HYDROLOGIC BUDGET
A Comparative Analysis of Multi-Source Water Supply Data for Pima County, Arizona,
W80-00644 6D

Projected Water Use and Water Budget Calculations for Pima County, Arizona,
W80-00647 6B

HYDROLOGIC CYCLE
World Water Balance and Water Resources of the Earth,
W80-00466 2A

Simulation Analyses: The Detailed Model,
W80-00561 2A

HYDROLOGIC DATA
Application of the Aquatic Model Cleaner to a Stratified Reservoir System,
W80-00520 5C

A Comparative Analysis of Multi-Source Water Supply Data for Pima County, Arizona,
W80-00644 6D

Water Use Information for Pima County, Arizona,
W80-00645 7B

Statistical Summaries of Arizona Streamflow Data,
W80-00771 2E

Water Resources Data for Wisconsin, Water Year 1978.
W80-00777 7C

Water Resources Data for South Carolina, Water Year 1978.
W80-00778 7C

Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 1. Hawaii.
W80-00779 7C

Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 2. Trust Territory of the Pacific Islands, Guam, American Samoa, and Northern Mariana Islands,
W80-00780 7C

HYDROLOGICAL SERVICES
Evaluation of Economic Benefits of Hydrological Services,
W80-00414 6B

HYDROLOGY
Isotope Hydrology.
W80-00421 4A

Hydrological and Geochemical Mass Balance in Small Forested and Agricultural Basins,
W80-00703 2A

HYDROPONICS
Wastewater as a Source of Nutrients and Water for Hydroponic Crop Production in Arid Regions,
W80-00642 5F

HYSTERESIS
Relations Between Geometrical Properties of Glass Beads Media and Their Main Psi(Theta) Hysteresis Loops,
W80-00598 2G

ICE
Glaciological Data: Workshop on Snow Cover and Sea Ice Data.
W80-00566 2C

Snow and Ice Data Sets for Climate and Water Resource Studies with Particular Reference to North America,
W80-00567 2C

Ultrasonic Velocity Investigations of Crystal Anisotropy in Deep Ice Cores from Antarctica,
W80-00739 2C

ICE COVER
Accuracy of Snow and Ice Monitoring,
W80-00575 2C

Oxygen Depletion and Winterkill Risk in Small Prairie Lakes Under Extended Ice Cover,
W80-00668 5A

ICED LAKES
Oxygen Depletion and Winterkill Risk in Small Prairie Lakes Under Extended Ice Cover,
W80-00668 5A

ILLINOIS
Phytoplankton in the Fox Chain of Lakes,
W80-00686 5C

Water Withdrawals in Illinois, 1978,
W80-00722 7C

Effects of Urbanization on the Magnitude and Frequency of Floods in Northeastern Illinois,
W80-00769 4C

IMPOUNDMENT
Floral and Faunal Changes in Lowland Hardwood Forests in Missouri Resulting from Channelization, Drainage, and Impoundment,
W80-00528 6G

IMPOUNDMENTS
Cooling Impoundments: Classification and Analysis,
W80-00580 2H

INCENTIVES
Principles and Methods for the Provision of Economic Incentives in Water Supply and Waste Water Disposal Systems.
W80-00436 6B

INDIA
Conservation Bench Terraces for Rice in a Subhumid Climate,
W80-00595 3F

INDIANA
The Application of a Digital Model for Evaluating the Bedrock Water Resources of the Maumee River Basin, Northwestern Ohio,
W80-00726 2F

INDIRECT BENEFIT
Federal Tax Incentives for Private Environmental Planning,
W80-00496 6E

INDUCED INFILTRATION
Ground Water Replenishment from Riverflow,
W80-00604 2F

INDUSTRIAL WASTES
Toxic Substances in Water--The U.S. Experience.
W80-00456 5G

Main Trends in Treatment of Municipal and Industrial Sewage in the USSR,
W80-00464 5D

On Water Reuse Promotion Measures,
W80-00477 6F

Some Observations on Pollutants of Velsao Bay (GOA),
W80-00688 5A

Survey of the Pollution in a Coastal Area of the Tyrrhenian Sea. Aerial Photography, Physico-Chemical and Microbiological Investigations and Mutagenic Monitoring,
W80-00796 5A

INDUSTRIAL WATER
The Industrial Water Service of Japan,
W80-00476 6E

INDUSTRIAL WATER SERVICE (JAPAN)
The Industrial Water Service of Japan,
W80-00476 6E

INDUSTRIES
The Promise of Technology: Potential and Limitations, Part One,
W80-00402 6A

INFILTRATION
Natural Control of the Chemical Composition of Water During the Infiltration Process--First Results (Acquisition de la Composition Chimique de L'Eau au Cours de L'Infiltration en Milieu Naturel--Premiers Resultats D'Une Etude Experimentale),
W80-00719 5B

Recharge to Low-Level Radioactive-Waste Burial Trenches 11 Through 14, West Valley, New York,
W80-00775 5E

INFORMATION EXCHANGE
Current Methodologies for the Collection and Dissemination of Water Resources Data in the United States,
W80-00474 7A

INFORMATION MATRIX
Instream Flow Strategies for Washington,
W80-00531 6E

Instream Flow Strategies for California,
W80-00532 6E

INFRARED RADIATION
A DMSP Near IR Sensor for Cloud/Snow Discrimination,
W80-00570 7B

INLAND WATERWAYS
U.S. Inland Water Transportation,
W80-00473 6E

INSTABILITIES
On the Growth of Instabilities in Groundwater Due to Temperature and Salinity Gradients,
W80-00605 2F

INSTITUTIONS
Present and Future Activities of the United Nations System in Water Resources Development.
W80-00405 6A

Evaluation of Economic Benefits of Hydrological Services,
W80-00414 6B

The Design and Evaluation of Institutional Arrangements for Water Planning and Management,
W80-00431 6E

Policy and Organization of Water Research in the United Kingdom.
W80-00439 6A

INTAKES
A Seasonal Survey of Fish Populations in the Lower Medway Estuary, Kent, Based on Power Station Screen Samples,
W80-00650 5C

INTER-AGENCY COOPERATION
Water-Resources Investigations in Nevada, 1978.
W80-00776 7A

INTERCEPTION
Rainfall Interception by Eight Small Trees,
W80-00744 2I

INTERNATIONAL COOPERATION
Present and Future Activities of the United Nations System in Water Resources Development.
W80-00405 6A

Eutrophication and Rehabilitation of Surface Waters,
W80-00417 5C

Note to the United Nations Water Conference on Preparations for the United Nations Conference on Desertification.
W80-00422 2A

Technical Cooperation Among Developing Countries with Regard to Water Resources Development.
W80-00425 6E

International River Basin Co-Operation: The Lessons from Experience,
W80-00430 6A

Experiences in Joint Administration of Border Watercourses,
W80-00452 6A

Deterioration of Water Quality Due to Long Range Transport of Air Pollution,
W80-00458 5G

INTERNATIONAL JOINT COMMISSION
Boundary Waters Management,
W80-00480 6E

INTERNATIONAL LAW
Work of the International Law Commission on the Law of the Non-Navigational Uses of International Watercourses.
W80-00423 6E

INTERNATIONAL LAW COMMISSION
Work of the International Law Commission on the Law of the Non-Navigational Uses of International Watercourses.
W80-00423 6E

INTERNATIONAL WATERS
Work of the International Law Commission on the Law of the Non-Navigational Uses of International Watercourses.
W80-00423 6E

International River Basin Co-Operation: The Lessons from Experience,
W80-00430 6A

Experiences in Joint Administration of Border Watercourses,
W80-00452 6A

Boundary Waters Management,
W80-00480 6E

INTERSTATE COMMISSIONS
Inter-State Rivers in Australia,
W80-00461 6E

INTERSTATE RIVERS
Inter-State Rivers in Australia,
W80-00461 6E

INTERTIDAL AREAS
Structure and Succession in Rocky Algal Communities of a Temperate Intertidal System,
W80-00504 5C

The Effects of Emergence and Submergence on the Photosynthesis and Respiration of Marine Macrophytes,
W80-00514 5C

INVESTIGATIONS
Water-Resources Investigations in Nevada, 1978.
W80-00776 7A

ION TRANSPORT
The Effect of Intense Fertilization on Migration of Nitrogen Compounds in Soil,
W80-00508 5C

Significance of Sorption Properties of Soils in Predicting the Migration of Nitrogen Compounds into Natural Waters,
W80-00510 5C

IRAQ
A Water Quality Study of a Stretch of the River Tigris,
W80-00623 5A

IRISH SEA
Shelf Sea Fronts' Adjustments Revealed by Satellite IR Imagery,
W80-00603 2L

IRON
The Role of Melano-Macrophage Centres in Iron Storage in Normal and Diseased Fish,
W80-00683 5A

Some Observations on Pollutants of Velsao Bay (GOA),
W80-00688 5A

Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

The Rock Oyster Saccostrea Glomerata as an Indicator of Trace Metals in Hong Kong,
W80-00793 5A

IRRADIATION
Seasonal Changes in the Spectral Composition of Downwelling Irradiance in Lake Kinneret (Israel),
W80-00629 2H

IRRIGATED AGRICULTURE
Summary: Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00633 6G

Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00634 6G

IRRIGATION
The Promise of Technology: Potential and Limitations. Part Two,
W80-00403 6A

Water for Agriculture.
W80-00424 4A

The Projects for the Increase of the Nile Yield with Special Reference to Jonglei Project,
W80-00447 4A

Water Usage Profile-Fort Carson Co.,
W80-00494 6D

Economic Parameters,
W80-00563 6B

Chemical Seepage from a Tail Water Recovery Pit to Adjacent Ground Water,
W80-00621 5B

Ground-Water Conditions and Potential for Artificial Recharge in Lucerne Valley, San Bernardino County, California,
W80-00763 4B

IRRIGATION EFFICIENCY
Irrigation Technology for Desert Land Reclamation,
W80-00641 3F

IRRIGATION OPERATION AND MAINTENANCE
Irrigation Management in Developing Countries: A Suggested Action Programme,
W80-00481 3F

Irrigation Technology for Desert Land Reclamation,
W80-00641 3F

IRRIGATION PRACTICES
Irrigation Technology for Desert Land Reclamation,
W80-00641 3F

IRRIGATION SYSTEMS
Irrigation Technology for Desert Land Reclamation,
W80-00641 3F

IRRIGATION WATER
Impact of Irrigation Water Salinity on Soil Runoff Water and Groundwater in Missouri,
W80-00635 3C

IRRIGATION WELLS
A Preliminary Appraisal of the Impact of Agriculture on Ground-Water Availability in Southwest Georgia,
W80-00770 4B

ISLANDS
Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 2. Trust Territory of the Pacific Islands, Guam, American Samoa, and Northern Mariana Islands,
W80-00780 7C

ISOPODS
Experimental and Field Studies on Ecological Energetics of Asellus Aquaticus L. (Isopoda). Energy Budget of a Population in the Littoral Zone of Powsinskie Lake,
W80-00507 5C

ISOTOPE STUDIES
Isotopic Composition of River Runoff on the U.S. East Coast: Evaluation of Stable Isotope Versus Salinity Plots for Coastal Water Mass Identification,
W80-00607 2L

ISRAEL
Water Resources Development, and Management Planning in Arid Zones: Case History-Israel,
W80-00457 6A

Israel- A Model of Efficient Utilization of a Country's Water Resources,
W80-00471 6E

Seasonal Changes in the Spectral Composition of Downwelling Irradiance in Lake Kinneret (Israel),
W80-00629 2H

ITALY
Low-Frequency Sea Level and Current Fluctuations Along the Coast of Northwest Italy,
W80-00742 2L

JAPAN
The Industrial Water Service of Japan,
W80-00476 6E

On Water Reuse Promotion Measures,
W80-00477 6F

JETS
Source Schematization Effects on Farfield Results,
W80-00723 2H

JETTIES
Tillamook Bay Entrance Refraction Study, Tillamook, Oregon,
W80-00501 8A

JORDANELLA
Chronic Toxicity of Vanadium to Flagfish,
W80-00795 5A

KAMLOOPS LAKE (BRITISH COLUMBIA)
Importance of Lake-River Interaction on Seasonal Patterns in the General Circulation of Kamloops Lake, British Columbia,
W80-00631 2H

KANSAS
Determination of Peak Discharge from Rainfall Data for Urbanized Basins, Wichita, Kansas,
W80-00774 6A

KELPS
The Effects of Emergence and Submergence on the Photosynthesis and Respiration of Marine Macrophytes,
W80-00514 5C

KENTUCKY
Flood Plain Information: Ohio River, Hancock County, Kentucky,
W80-00537 2E

Flood Plain Information: Ohio River, Boone County, Kentucky,
W80-00539 2E

Floods of December 1978 in Kentucky,
W80-00758 2E

KIDNEY
Nephrocalcinosis in Rainbow Trout Salmo Gairdneri Richardson; The Effect of Exposure to Elevated CO2 Concentrations,
W80-00674 5A

The Role of Melano-Macrophage Centres in Iron Storage in Normal and Diseased Fish,
W80-00683 5A

KINEMATIC WATERSHED MODELS
An Application Runoff Model Strategy for Ungaged Watersheds,
W80-00728 2E

KINETICS
Growth and Competition of the Marine Diatoms Phaeodactylum Tricornutum and Thalassiosira Pseudonana, I. Nutrient Effects,
W80-00515 5C

Rate Controlling Processes in the Release of Radium-226 from Uranium Mill Tailings, II. Kinetic Study,
W80-00601 5B

KIRYAS JOEL (NY)
Ground-Water Appraisal for the Community of Kiryas Joel, Orange County, New York,
W80-00759 2A

LABOR
Water, Women, and Development,
W80-00416 6A

LABOR-INTENSIVE
World Bank: An Approach for Selection of Labour Vs. Capital Intensive Technologies for Water Resource Development Projects.
W80-00412 6C

Basic Needs Strategy and Water Resources Policy,
W80-00418 6A

World Employment Programme: Appropriate Construction Technology for Water Control and Irrigation Works in Developing Countries,
W80-00419 6A

LABORATORY TESTS
A Wind Tunnel Investigation of the Rate of Evaporation of Large Water Drops Falling at Terminal Velocity in Air,
W80-00602 2B

A Modified Permeameter for Measuring Hydraulic Conductivity of Soils,
W80-00614 2G

Mutagenic Activity in Organic Wastewater Concentrates,
W80-00670 5A

LAKE BALATON (HUNGARY)
A Simple Eutrophication Model for the Bay of Keszthely, Lake Balaton,
W80-00712 2L

LAKE CARL BLACKWELL (OK)
The Effects of pH on the Aluminum, Iron and Calcium Phosphate Fractions of Lake Sediments,
W80-00588 2J

LAKE KINNERET (ISRAEL)
Seasonal Changes in the Spectral Composition of Downwelling Irradiance in Lake Kinneret (Israel),
W80-00629 2H

LAKE MENDOTA
Metabolism of Toxaphene by Aquatic Sediment and a Camphor-Degrading Pseudomonad,
W80-00511 5C

LAKE MORPHOMETRY
A Survey of the Biota, Environment and Use for Recreation of Twelve Lakes in Snowdonia,
W80-00699 5C

LAKE ONTARIO
Nutrient Exchange Between Volume Elements of Large Lakes,
W80-00716 2H

LAKE PAIJANNE (FINLAND)
Adaptation of the EPAECO Model to a Lake in Central Finland,
W80-00710 2L

LAKE RESTORATION
Eutrophication and Rehabilitation of Surface Waters,
W80-00417 5C

LAKE SEDIMENTS
The Effects of pH on the Aluminum, Iron and Calcium Phosphate Fractions of Lake Sediments,
W80-00588 2J

LAKES
Work of the International Law Commission on the Law of the Non-Navigational Uses of International Watercourses.
W80-00423 6E

A Model for Simulating Lake Ecosystems,
W80-00521 5C

Weak and Strong Acids in the Surface Waters of the Tovdal Region in S. Norway,
W80-00624 2K

Seasonal Changes in the Spectral Composition of Downwelling Irradiance in Lake Kinneret (Israel),
W80-00629 2H

Importance of Lake-River Interaction on Seasonal Patterns in the General Circulation of Kamloops Lake, British Columbia,
W80-00631 2H

Phytoplankton in the Fox Chain of Lakes,
W80-00686 5C

Adaptation of the EPAECO Model to a Lake in Central Finland,
W80-00710 2L

A Mathematical Ecosystem Model Applicable to Shallow Water Bodies,
W80-00711 2L

A Simple Eutrophication Model for the Bay of Keszthely, Lake Balaton,
W80-00712 2L

Energy Exchange Between Deep Lakes and the Atmosphere and the Consequences for the Wind-Mixed Layer Dynamics,
W80-00713 2L

New Aspects of the Consideration of Feedback Mechanisms in an Ecological Model of the Pelagic Zone,
W80-00715 2H

Nutrient Exchange Between Volume Elements of Large Lakes,
W80-00716 2H

Water Quality in Lentic Water Bodies (Lakes and Reservoirs),
W80-00717 2H

Modelling of the Eutrophication Process in Lakes and Reservoirs,
W80-00718 2H

Comparison of Selected Cultural, Physical, and Water-Quality Characteristics of Lakes in Washington,
W80-00766 2H

LAMPRICIDES
Toxicity of Fishery Chemicals to the Asiatic Clam, Corbicula Manilensis,
W80-00785 5A

LAND APPLICATION
Potential Ground Water Pollution from Sewage Sludge Application on Agricultural Land,
W80-00489 5G

LAND DEVELOPMENT
Impacts of a Large Recreational Development on Water Quality in a Semi-Primitive Environment,
W80-00498 5C

LAND DRAINAGE
Guidelines for Urban Development in Louisiana's Coastal Wetlands,
W80-00547 4C

LAND TREATMENT
Long-Term Effects of Land Application of Domestic Wastewater: Vineland, New Jersey, Rapid Infiltration Site,
W80-00529 5E

LAND USE
Federal Tax Incentives for Private Environmental Planning,
W80-00496 6E

Sediment Yield and Land Use in Tropical Catchments,
W80-00746 2J

LATIN AMERICA
Report of the Regional Preparatory Meeting of the Countries of Latin America and the Caribbean for the United Nations Water Conference,
W80-00407 6A

The Water Resources of Latin America Regional Report,
W80-00415 6A

LAW ENFORCEMENT
Swedish Policy for Water Quality Protection,
W80-00454 6E

LEACHING
Rate Controlling Processes in the Release of Radium-226 from Uranium Mill Tailings, I. Leaching Study,
W80-00600 5B

LEAD
Body Burden of Chromium, Copper, Cadmium and Lead in the Neustonic Copepod Anomalocera Patersoni (Pontellidae) Collected from the Mediterranean Sea,
W80-00665 5A

The Effect of Cadmium and Lead on the Growth of Two Species of Marine Phytoplankton with Particular Reference to the Development of Tolerance,
W80-00676 5A

A Morphometric Study of Lead and Copper Effects on Diatoma Tenue Var. Elongatum (Bacillariophyta),
W80-00782 5A

Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates

as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

Lead and Mercury in Lesser Snow Geese Wintering in Louisiana,
W80-00799 5A

LEAKAGE
Casing and Leak Depths, and Solute Travel Times to Wells,
W80-00579 5B

LEGISLATION
Water Law and Legislation: How to use them to Obtain Optimum Results from Water Resources,
W80-00428 6E

Water USA: 1776-1976,
W80-00486 6E

LEIOSTOMUS
Thermal Shock Resistance of Spot (Leiostomus Xanthurus) After Acclimation to Constant or Cycling Temperature,
W80-00652 5C

LENTIC ENVIRONMENT
Water Quality in Lentic Water Bodies (Lakes and Reservoirs),
W80-00717 2H

LEON COUNTY (FLA)
Water-Quality Assessment of Runoff from a Rural Highway Bridge Near Tallahassee, Florida,
W80-00767 5B

LETHAL LIMIT
Acute Toxicity of Copper, Cadmium and Zinc to Three Species of Marine Copepod,
W80-00679 5A

LIGANDS
Measurement of Complexing Materials Excreted from Algae and Their Ability to Ameliorate Copper Toxicity,
W80-00667 5A

LIMNOLOGY
CMEA Glossary on Water Management,
W80-00437 6A

Comparison of Selected Cultural, Physical, and Water-Quality Characteristics of Lakes in Washington,
W80-00766 2H

LITTLE OSSIPEE RIVER (ME)
Flood Hazard Analyses, Little Ossipee River, Towns of Acton, Newfield and Shapleigh, Maine, York County.
W80-00535 2E

LIVER
Hepatomas in Atlantic Tomcod Microgadus Tomcod (Walbaum) Collected in the Hudson River Estuary in New York,
W80-00675 5B

The Role of Melano-Macrophage Centres in Iron Storage in Normal and Diseased Fish,
W80-00683 5A

LONG ISLAND (NY)
Integrated Planning and Water Quality Management: The Federal Water Pollution Control Act Amendments of 1972 and Coastal Zone Management,
W80-00527 6E

LONG-TERM PLANNING
Long-Term Planning of Water Management,
W80-00434 6A

The Long-Term National Programme for River Basin Development, Basis of the Water Management Policy in Romania,
W80-00450 6A

LOUISIANA
Flood Plain Information: Bayou Bonfouca-Bayou Vincent W-14 Main Diversion Canal Doubloon Branch-French Branch, Slidell, Louisiana and Vicinity,
W80-00536 2E

Flood Plain Information: Baton Rouge, Louisiana, No. 5, Cypress Bayou and Tributaries,
W80-00540 2E

Flood Plain Information: Baton Rouge, Louisiana, No 4. Hurricane Creek, Monte Sano Bayou and Tributaries,
W80-00541 2E

Guidelines for Urban Development in Louisiana's Coastal Wetlands,
W80-00547 4C

LUCERNE VALLEY
Ground-Water Conditions and Potential for Artificial Recharge in Lucerne Valley, San Bernardino County, California,
W80-00763 4B

MAINE
Flood Hazard Analyses, Little Ossipee River, Towns of Acton, Newfield and Shapleigh, Maine, York County.
W80-00535 2E

MAINTENANCE COSTS
Analysis of Operations and Maintenance Costs for Municipal Wastewater Treatment Systems,
W80-00549 6B

MALATHION
Electric Fish as a Tool for Water Quality Assessment,
W80-00659 5A

MANAGEMENT
The United States Experience in Flood Plain Management,
W80-00459 6F

MANAGEMENT STRATEGIES
Urban Stormwater Pollution: An Investigation of the Problem and Its Control,
W80-00525 5B

MANGANESE
Some Observations on Pollutants of Velsao Bay (GOA),
W80-00688 5A

Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

MANPOWER
Water, Women, and Development,
W80-00416 6A

World Employment Programme: Appropriate Construction Technology for Water Control and Irrigation Works in Developing Countries,
W80-00419 6A

Assessment of Water Resources: Networks, Surveys, Services, and Related Facilities: Present Status and Requirements by 2000.
W80-00426 6A

MAPPING
Mapping and Archiving of Canadian Sea Ice Data,
W80-00569 7C

Archiving and Mapping of Canadian Snow Cover Data,
W80-00574 2C

NASA Mapping Projects (Summary),
W80-00578 7C

MAPS
Data Sources and Sea Ice Products of Fleet Weather Facility/Joint Ice Center, Suitland,
W80-00568 2C

Satellite-Derived River Basin Snow-Cover Percentages: A New Data Base for Hydrologists,
W80-00572 7B

MARIANA ISLANDS
Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 2. Trust Territory of the Pacific Islands, Guam, American Samoa, and Northern Mariana Islands,
W80-00780 7C

MARINE ALGAE
The Concentration and Speciation of Arsenic in Marine Macro-Algae,
W80-00658 5A

MARINE BACTERIA
Distribution of Suspended Bacteria in Neritic Waters South of Long Island During Stratified Conditions,
W80-00627 2L

MARINE BIOLOGY
The Production and Fate of Phytoplankton Size Fractions in the Plume of the Hudson River, New York Bight,
W80-00628 2L

MARINE FISH
Survey of Demersal Fish in Port Phillip Bay for Incidence of Neoplasia,
W80-00680 5A

MARMOT BASIN (ONTARIO)
Sources, Transportation and Utilization of Dissolved Organic Matter in Groundwater and Streams,
W80-00530 2F

MARSHES
Effects of Treated Effluent on a Natural Marsh,
W80-00677 5B

MARYLAND
Detailed Structure of pH in Hydrometeors,
W80-00616 2K

Summertime Synoptic Variability of the Middle Atlantic Shelf Water/Slope Water Front,
W80-00740 2L

MASS TRANSFER
Mass Transfer Models of Sorption and Desorption of Radionuclides by Aquatic Plants,
W80-00705 2A

MATHEMATICAL MODELS
Environmental Aspects of Pollution Control in Hungary,
W80-00441 6A

Computerized Optimization of Water Releases from Reservoirs,
W80-00445 4A

Appropriative Water Rights and Efficient Allocation of Resources,
W80-00548 6E

Applied Water Resource Systems Planning,
W80-00554 6A

Planning Theory: The Role of Mathematical Models in Water Resources Planning,
W80-00557 6A

Planning for the Rio Colorado: An Overview,
W80-00558 6A

Economic Parameters,
W80-00563 6B

Casing and Leak Depths, and Solute Travel Times to Wells,
W80-00579 5B

Absorption of Water by Soil: The Constant Flux Boundary Condition,
W80-00596 2G

Foundation Theories of Solute Transport in Porous Media: A Critical Review,
W80-00606 2A

Oxygen Depletion and Winterkill Risk in Small Prairie Lakes Under Extended Ice Cover,
W80-00668 5A

On the Theoretical Basis of Modelling the Quality of Surface and Subsurface Waters,
W80-00700 5B

A Dynamic Model of the Chemical Nutrient System for Research of the Ecological Consequences in Natural Water,
W80-00701 5B

An Effort for Modelling the Transport of Micropollutants in Rivers,
W80-00702 5B

Effects of the Construction of a Broad Waterway on the Water Quality of the Doubs (Effets de la Canalisation a Grand Gabarit sur la Qualite des Eaux du Doubs),
W80-00704 5B

On the Choice of Boundary Conditions for One-Dimensional Models of Estuarine Water Quality,
W80-00706 2L

A Mathematical Ecosystem Model Applicable to Shallow Water Bodies,
W80-00711 2L

A Simple Eutrophication Model for the Bay of Keszthely, Lake Balaton,
W80-00712 2L

Energy Exchange Between Deep Lakes and the Atmosphere and the Consequences for the Wind-Mixed Layer Dynamics,
W80-00713 2L

Heat and Mass Exchange Coefficients for Open Water Surfaces,
W80-00714 2D

Computation of the Advancement of Groundwater Pollution Due to Petroleum Products Originating from a Known Source of Contamination (Le Calcul de la Propagation de la Pollution des Eaux Souterraines par des Materiaux Huileux, Provenants D'une Source de la Pollution Connue),
W80-00720 5B

Source Schematization Effects on Farfield Results,
W80-00723 2H

A Galerkin in Time, Linearized Finite Element Model of 2-Dimensional Unsaturated Porous Media Drainage,
W80-00753 2G

Evaluation of a Digital Model for Estuarine Water Quality Simulation in Waste Allocation Studies,
W80-00761 5B

MATHEMATICAL STUDIES
The Use of the Salinity Maximum of the Equatorial Undercurrent for Estimating Nutrient Enrichment and Primary Production in the Gulf of Guinea,
W80-00781 5C

MAUMEE RIVER BASIN (OH)
The Application of a Digital Model for Evaluating the Bedrock Water Resources of the Maumee River Basin, Northwestern Ohio,
W80-00726 2F

MEASUREMENT
Estimating the Gas and Dye Quantities for Modified Tracer Technique Measurements of Stream Reaeration Coefficients,
W80-00773 5B

MELBOURNE (AUSTRALIA)
A Method of Aquifer Testing and Its Application to an Anisotropic Inhomogeneous Multiple Aquifer System,
W80-00727 2F

MERCURY
A History of Mercury Levels in Swedish Fauna,
W80-00649 5A

Total and Methylmercury Levels in Three Species of Whelks,
W80-00656 5A

Study of Metal Contents of Elasmobranch Fishes: Part I-Metal Concentration in the Muscle Tissues of a Dogfish, Squalus Mitsukurii,
W80-00685 5A

Lead and Mercury in Lesser Snow Geese Wintering in Louisiana,
W80-00799 5A

METALS
Trace Metals in Seaducks of the Fraser River Delta Intertidal Area, British Columbia,
W80-00657 5A

Body Burden of Chromium, Copper, Cadmium and Lead in the Neustonic Copepod Anomalocera Patersoni (Pontellidae) Collected from the Mediterranean Sea,
W80-00665 5A

Chronic Toxicity of Vanadium to Flagfish,
W80-00795 5A

METAMORPHOSIS
Interactive Effects of Salinity, Temperature and Polycyclic Aromatic Hydrocarbons on the Survival and Development Rate of Larvae of the Mud Crab Rhithropanopeus Harrisii,
W80-00790 5A

METHODOLOGY
World Bank: An Approach for Selection of Labour Vs. Capital Intensive Technologies for Water Resource Development Projects.
W80-00412 6C

Water Law and Legislation: How to use them to Obtain Optimum Results from Water Resources,
W80-00428 6E

Rational Methods of Flood Control Planning in River Basin Development,
W80-00435 6A

Principles and Methods for the Provision of Economic Incentives in Water Supply and Waste Water Disposal Systems.
W80-00436 6B

Main Trends in Treatment of Municipal and Industrial Sewage in the USSR,
W80-00464 5D

The Main Directions of Hydrogeological Investigations for the Substantiation of Artificial Recharge,
W80-00468 2A

An Analysis of Values for Development of Recreational Policy,
W80-00500 6A

Guidelines for Urban Development in Louisiana's Coastal Wetlands,
W80-00547 4C

Applied Water Resource Systems Planning,
W80-00554 6A

Planning for the Rio Colorado: An Overview,
W80-00558 6A

Economic Parameters,
W80-00563 6B

Optimal Management of a Multireservoir Water Supply System,
W80-00583 4A

Acute Toxicity of Copper, Cadmium and Zinc to Three Species of Marine Copepod,
W80-00679 5A

METHYLMERCURY
Total and Methylmercury Levels in Three Species of Whelks,
W80-00656 5A

MICROBIAL DEGRADATION
Phosphorus Cycling in Alaskan Coastal Tundra: A Hypothesis for the Regulation of Nutrient Cycling,
W80-00503 5C

Metabolism of Toxaphene by Aquatic Sediment and a Camphor-Degrading Pseudomonad,
W80-00511 5C

Degradation of Selected Polycyclic Aromatic Hydrocarbons in Coastal Sediments: Importance of Microbes and Polychaete Worms,
W80-00613 5A

MICROBIOLOGY
Microbiological Water Quality in Relation to Public Health,
W80-00482 3C

MICROORGANISMS
Microbial Effects on Soil Erodibility,
W80-00594 2J

MICROPOLLUTANT TRANSPORT
An Effort for Modelling the Transport of Micropollutants in Rivers,
W80-00702 5B

MIDDLE EAST
Report of the Economic Commission for Western Asia Regional Preparatory Meeting.
W80-00410 6A

MILITARY RESERVATIONS
Water Usage Profile-Fort Carson Co.,
W80-00494 6D

MINE DRAINAGE
Effects of Acid Mine Drainage on a Southwestern Pennsylvania Stream,
W80-00684 5A

MINE WASTES
Pollution Control in the Mining Industry in South Africa,
W80-00484 5G

Rate Controlling Processes in the Release of Radium-226 from Uranium Mill Tailings, I. Leaching Study,
W80-00600 5B

Rate Controlling Processes in the Release of Radium-226 from Uranium Mill Tailings, II. Kinetic Study,
W80-00601 5B

MINGO SWAMP (MO)
Floral and Faunal Changes in Lowland Hardwood Forests in Missouri Resulting from Channelization, Drainage, and Impoundment,
W80-00528 6G

MINING
Pollution Control in the Mining Industry in South Africa,
W80-00484 5G

An Assessment of the Effects of Bathymetric Changes Associated with Sand and Gravel Mining on Tidal Circulation in the Lower Bay of New York Harbor,
W80-00693 2J

The Impact of Dredged Holes on Oxygen Demand in the Lower Bay, New York Harbor,
W80-00694 4C

MISSISSIPPI RIVER
Geomorphic Study of Upper Mississippi River,
W80-00585 2E

MISSOURI RIVER BASIN
Floral and Faunal Changes in Lowland Hardwood Forests in Missouri Resulting from Channelization, Drainage, and Impoundment,
W80-00528 6G

MIXING
Estimates of Vertical Eddy Diffusion Through the Thermocline from Phytoplankton Nitrate Uptake Rates in the Mixed Layer of the Eastern Tropical Pacific,
W80-00630 2L

The Use and Limitations of a Two-Dimensional Mixing Model for Rivers,
W80-00708 5B

The Use of the Salinity Maximum of the Equatorial Undercurrent for Estimating Nutrient Enrichment and Primary Production in the Gulf of Guinea,
W80-00781 5C

MODE OF ACTION
Toxicity and Pharmacology of Extracts from Dorid Nudibranchs,
W80-00673 5A

MODEL OUTPUT
Outputs of the Models,
W80-00565 6A

MODEL STUDIES
Urban Residential Demand for Water in the United States,
W80-00495 6D

Tillamook Bay Entrance Refraction Study, Tillamook, Oregon,
W80-00501 8A

Application of the Aquatic Model Cleaner to a Stratified Reservoir System,
W80-00520 5C

A Model for Simulating Lake Ecosystems,
W80-00521 5C

Mathematical Modeling of Phytoplankton Kinetics with Application to Two Alpine Lakes,
W80-00522 5C

The Mathematical Programming Screening Model,
W80-00559 6A

Simulation Analyses: The Basic Model,
W80-00560 6A

Simulation Analyses: The Detailed Model,
W80-00561 2A

The Mathematical Programming Sequencing Model,
W80-00562 6A

Geomorphic Study of Upper Mississippi River,
W80-00585 2E

Dye-Vector Flow Visualization--Cooling Water Model,
W80-00586 8B

A Storage Routing Model Based on Catchment Geomorphology,
W80-00590 2E

Some Dimensional Considerations in the Unit Hydrograph Theory,
W80-00591 2E

Nature and Properties of Water in Montmorillonite-Water Systems,
W80-00597 2G

On the Generation of the Seasonal Coastal Upwelling in the Gulf of Guinea,
W80-00608 2L

Mass Transfer Models of Sorption and Desorption of Radionuclides by Aquatic Plants,
W80-00705 2A

The Biocenotic Model,
W80-00707 5B

The Use and Limitations of a Two-Dimensional Mixing Model for Rivers,
W80-00708 5B

Use of Water Quality Variables for Estimation of Water Quantity Characteristics,
W80-00709 2A

Adaptation of the EPAECO Model to a Lake in Central Finland,
W80-00710 2L

New Aspects of the Consideration of Feedback Mechanisms in an Ecological Model of the Pelagic Zone,
W80-00715 2H

Nutrient Exchange Between Volume Elements of Large Lakes,
W80-00716 2H

Water Quality in Lentic Water Bodies (Lakes and Reservoirs),
W80-00717 2H

Modelling of the Eutrophication Process in Lakes and Reservoirs,
W80-00718 2H

Simulation Model of the Evolution of the Chemical Composition of a Mineral-Solution System and its Applications (Modele de Simulation de L'Evolution de la Composition Chimique d'un Systeme Mineraux-Solution et ses Applications),
W80-00721 5A

The Application of a Digital Model for Evaluating the Bedrock Water Resources of the Maumee River Basin, Northwestern Ohio,
W80-00726 2F

An Application Runoff Model Strategy for Ungaged Watersheds,
W80-00728 2E

Turbulent Flow in a Depth-Limited Boundary Layer,
W80-00741 8B

A Dimensionally Homogeneous and Statistically Optimal Model for Predicting Mean Annual Flood,
W80-00747 2E

A Statistical Method for Modelling the Fate of Rainfall in a Tropical Rainforest Catchment,
W80-00748 2E

A Finite-Element Distributed Catchment Model, II. Application to Real Catchments,
W80-00749 2E

Digital Model of the Hollister Valley Ground-Water Basin, San Benito County, California,
W80-00756 6A

Evaluation of a Digital Model for Estuarine Water Quality Simulation in Waste Allocation Studies,
W80-00761 5B

MOLLUSKS
Toxicity and Pharmacology of Extracts from Dorid Nudibranchs,
W80-00673 5A

MONITORING
Evaluation of Economic Benefits of Hydrological Services,
W80-00414 6B

Accuracy of Snow and Ice Monitoring,
W80-00575 2C

Mutagenic Activity in Organic Wastewater Concentrates,
W80-00670 5A

Temperature-Monitoring and Safety-Control Device,
W80-00783 5A

MONTANA
Impacts of a Large Recreational Development on Water Quality in a Semi-Primitive Environment,
W80-00498 5C

MONTE SANO BAYOU (LA)
Flood Plain Information: Baton Rouge, Louisiana, No 4, Hurricane Creek, Monte Sano Bayou and Tributaries,
W80-00541 2E

MONTMORILLONITE
Nature and Properties of Water in Montmorillonite-Water Systems,
W80-00597 2G

MORTALITY
The Survival of Smolts of Salmon Salmo Salar L. at Low Concentrations of Dissolved Oxygen,
W80-00655 5A

MOUNTAINS
Rehabilitation of Catchment Areas in Mountain Regions,
W80-00469 4A

MS-222
Comparison of Anesthetic Potency of Benzocaine Hydrochloride and MS-222 in Two Freshwater Fish Species,
W80-00784 5A

MULTIOBJECTIVE
Applied Water Resource Systems Planning,
W80-00554 6A

MULTIOBJECTIVE INVESTMENT CRITERIA
Planning for the Rio Colorado: An Overview,
W80-00558 6A

MULTIOBJECTIVE THEORY
Planning Theory: Multiobjectives,
W80-00556 6A

MULTIPLE PURPOSE PROJECTS
Planning Status Report, Water Resources Appraisals for Hydroelectric Licensing: Lower Arkansas River Basin-Arkansas, Colorado, Kansas, New Mexico, Oklahoma and Texas,
W80-00533 6D

MULTIPLE-PURPOSE RESERVOIRS
Hydrological Forecasting for Operational Planning and Management of Water Resources,
W80-00467 2E

MULTISPECTRAL SCANNERS
Remote Sensing for Water Resources Management.
W80-00475 7B

MUNICIPAL WASTES
Main Trends in Treatment of Municipal and Industrial Sewage in the USSR,
W80-00464 5D

On Water Reuse Promotion Measures,
W80-00477 6F

Environmental Pollution Control Alternatives: Municipal Wastewater,
W80-00544 5D

Wastewater as a Source of Nutrients and Water for Hydroponic Crop Production in Arid Regions,
W80-00642 5F

MUNICIPAL WASTEWATER
Analysis of Operations and Maintenance Costs for Municipal Wastewater Treatment Systems,
W80-00549 6B

MURRAY RIVER (AUSTRALIA)
Inter-State Rivers in Australia,
W80-00461 6E

MUSKRATS
Reduction of Aquatic Vegetation Following the Colonization of a Northern Swedish Lake by the Muskrat, Ondatra Zibethica,
W80-00513 5C

MUSSELS
Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

MUTAGENICITY
Mutagenic Activity in Organic Wastewater Concentrates,
W80-00670 5A

MUTAGENS
Survey of the Pollution in a Coastal Area of the Tyrrhenian Sea. Aerial Photography, Physico-Chemical and Microbiological Investigations and Mutagenic Monitoring,
W80-00796 5A

NAPHTHALENE
Interactive Effects of Salinity, Temperature and Polycyclic Aromatic Hydrocarbons on the Survival and Development Rate of Larvae of the Mud Crab Rhithropanopeus Harrisii,
W80-00790 5A

NAVIGABLE WATERS
U.S. Inland Water Transportation,
W80-00473 6E

NEOPLASMS
Hepatomas in Atlantic Tomcod Microgadus Tomcod (Walbaum) Collected in the Hudson River Estuary in New York,
W80-00675 5B

Survey of Demersal Fish in Port Phillip Bay for Incidence of Neoplasia,
W80-00680 5A

NERITIC
Distribution of Suspended Bacteria in Neritic Waters South of Long Island During Stratified Conditions,
W80-00627 2L

NETWORKS
Current Methodologies for the Collection and Dissemination of Water Resources Data in the United States,
W80-00474 7A

Drainage Network Power,
W80-00725 8E

NEVADA
Water-Resources Investigations in Nevada, 1978.
W80-00776 7A

NEW JERSEY
Summertime Synoptic Variability of the Middle Atlantic Shelf Water/Slope Water Front,
W80-00740 2L

NEW YORK
Integrated Planning and Water Quality Management: The Federal Water Pollution Control Act Amendments of 1972 and Coastal Zone Management,
W80-00527 6E

Textural Properties of Surficial Sediments of Lower Bay of New York Harbor,
W80-00696 2J

NEW YORK BIGHT
Distribution of Suspended Bacteria in Neritic Waters South of Long Island During Stratified Conditions,
W80-00627 2L

The Production and Fate of Phytoplankton Size Fractions in the Plume of the Hudson River, New York Bight,
W80-00628 2L

NEW YORK HARBOR
The Impact of Dredged Holes on Oxygen Demand in the Lower Bay, New York Harbor,
W80-00694 4C

NEW ZEALAND
Streamflow Generation in a Forested Watershed, New Zealand,
W80-00724 2E

NEWFIELD (ME)
Flood Hazard Analyses, Little Ossipee River, Towns of Acton, Newfield and Shapleigh, Maine, York County.
W80-00535 2E

NICKEL
Some Observations on Pollutants of Velsao Bay (GOA),
W80-00688 5A

NILE RIVER
The Projects for the Increase of the Nile Yield with Special Reference to Jonglei Project,
W80-00447 4A

NITRATES
The Effect of Intense Fertilization on Migration of Nitrogen Compounds in Soil,
W80-00508 5C

Significance of Sorption Properties of Soils in Predicting the Migration of Nitrogen Compounds into Natural Waters,
W80-00510 5C

Estimates of Vertical Eddy Diffusion Through the Thermocline from Phytoplankton Nitrate Uptake Rates in the Mixed Layer of the Eastern Tropical Pacific,
W80-00630 2L

The Use of the Salinity Maximum of the Equatorial Undercurrent for Estimating Nutrient Enrichment and Primary Production in the Gulf of Guinea,
W80-00781 5C

NITROGEN
Time Series Analysis of Ammonia in the Passaic River,
W80-00638 5C

NONRADIOACTIVE TRACERS
Estimating the Gas and Dye Quantities for Modified Tracer Technique Measurements of Stream Reaeration Coefficients,
W80-00773 5B

NONSTRUCTURAL ALTERNATIVES
The United States Experience in Flood Plain Management,
W80-00459 6F

NORTH AMERICA
Snow and Ice Data Sets for Climate and Water Resource Studies with Particular Reference to North America,
W80-00567 2C

NORTHEASTERN ILLINOIS
Effects of Urbanization on the Magnitude and Frequency of Floods in Northeastern Illinois,
W80-00769 4C

NORWAY
Weak and Strong Acids in the Surface Waters of the Tovdal Region in S. Norway,
W80-00624 2K

NUDIBRANCHS
Toxicity and Pharmacology of Extracts from Dorid Nudibranchs,
W80-00673 5A

NUMERICAL ANALYSIS
Modeling Groundwater Flow Fields Containing Point Singularities: A Technique for Singularity Removal,
W80-00609 2F

NUTRIENT REQUIREMENTS
The Biochemical Composition of the Larvae of Two Strains of Artemia Salina (L.) Reared on two Different Algal Foods,
W80-00502 5C

Growth and Competition of the Marine Diatoms Phaeodactylum Tricornutum and Thalassiosira Pseudonana, I. Nutrient Effects,
W80-00515 5C

Phytoplankton Succession in Nutrient Enriched Experimental Ponds As Related to Changing Carbon, Nitrogen, and Phosphorus Conditions,
W80-00517 5C

Unexpected Response to Vitamin B12 of Dominant Centric Diatoms from the Spring Bloom in the Gulf of Maine (Northeast Atlantic Ocean),
W80-00681 5C

NUTRIENTS
Eutrophication and Rehabilitation of Surface Waters,
W80-00417 5C

Mathematical Modeling of Phytoplankton Kinetics with Application to Two Alpine Lakes,
W80-00522 5C

Sediment and Nutrient Yield from Residential Construction Sites,
W80-00622 5B

Effects of Bottom Sediments on the Survival of Enterobacter Aerogenes in Seawater,
W80-00662 5A

Mixing an Enclosed, 1300 Cubic Meter Water Column: Effects on the Planktonic Food Web,
W80-00672 5A

Effects of Treated Effluent on a Natural Marsh,
W80-00677 5B

A Dynamic Model of the Chemical Nutrient System for Research of the Ecological Consequences in Natural Water,
W80-00701 5B

OBJECTIVES
Screening Objectives and Uncertainties in Water Resources Planning,
W80-00551 6A

OCEAN CIRCULATION
Shelf Sea Fronts' Adjustments Revealed by Satellite IR Imagery,
W80-00603 2L

OCEAN WAVES
Tillamook Bay Entrance Refraction Study, Tillamook, Oregon,
W80-00501 8A

Energetics of Breaking Waves Within the Surf Zone,
W80-00737 2L

OCEANS
World Water Balance and Water Resources of the Earth,
W80-00466 2A

Shelf Sea Fronts' Adjustments Revealed by Satellite IR Imagery,
W80-00603 2L

Summertime Synoptic Variability of the Middle Atlantic Shelf Water/Slope Water Front,
W80-00740 2L

OCHLOCKONEE RIVER
Water-Quality Assessment of Runoff from a Rural Highway Bridge Near Tallahassee, Florida,
W80-00767 5B

ODOR-PRODUCING ALGAE
The Source of Muddy Odor in Bream (Abramis Brama) from the Porvoo Sea Area (Gulf of Finland),
W80-00661 5A

OHIO
The Application of a Digital Model for Evaluating the Bedrock Water Resources of the Maumee River Basin, Northwestern Ohio,
W80-00726 2F

OHIO RIVER (KY)
Flood Plain Information: Ohio River, Hancock County, Kentucky,
W80-00537 2E

Flood Plain Information: Ohio River, Boone County, Kentucky,
W80-00539 2E

OIL
Sensitivity of Alaskan Freshwater and Anadromous Fishes to Prudhoe Bay Crude Oil and Benzene,
W80-00660 5A

Effects of Kuwait Oils on Feeding Rates of Copepods,
W80-00666 5A

Photooxidation Products of a Fuel Oil and Their Antimicrobial Activity,
W80-00671 5B

Petroleum Hydrocarbons in Urban Runoff,
W80-00730 5B

Toxic Effects of Aqueous Extracts of Ekofisk Crude Oil, Crude Oil Fractions, and Commercial Oil Products on the Development of Sea Urchin Eggs,
W80-00798 5A

OIL FIELDS
Environmental Assessment of an Active Oil Field in the Northwestern Gulf of Mexico 1977-1978. Volume III: Chemical and Physical Investigations.
W80-00692 5C

OIL SPILL
Photooxidation Products of a Fuel Oil and Their Antimicrobial Activity,
W80-00671 5B

OKLAHOMA
The Effects of pH on the Aluminum, Iron and Calcium Phosphate Fractions of Lake Sediments,
W80-00588 2J

ON-SITE INVESTIGATIONS
Natural Control of the Chemical Composition of Water During the Infiltration Process--First Results (Acquisition de la Composition Chimique de L'Eau au Cours de L'Infiltration en Milieu Naturel--Premiers Resultats D'Une Etude Experimentale),
W80-00719 5B

OPERATING COSTS
Analysis of Operations and Maintenance Costs for Municipal Wastewater Treatment Systems,
W80-00549 6B

OPERATION AND MAINTENANCE
Analysis of Operations and Maintenance Costs for Municipal Wastewater Treatment Systems,
W80-00549 6B

OPERATIONS RESEARCH
Analysis of Operations and Maintenance Costs for Municipal Wastewater Treatment Systems,
W80-00549 6B

OPTIMIZATION
Planning Theory: The Role of Mathematical Models in Water Resources Planning,
W80-00557 6A

Optimal Management of a Multireservoir Water Supply System,
W80-00583 4A

ORANGE COUNTY (NY)
Ground-Water Appraisal for the Community of Kiryas Joel, Orange County, New York,
W80-00759 2A

ORGANIC COMPOUNDS
Petroleum Hydrocarbons in Urban Runoff,
W80-00730 5B

ORGANIC WASTES
Concentration and Sources of Fecal and Organic Pollution in an Agricultural Watershed,
W80-00687 5A

OUTER CONTINENTAL SHELF
Environmental Assessment of an Active Oil Field in the Northwestern Gulf of Mexico 1977-1978. Volume III: Chemical and Physical Investigations.
W80-00692 5C

OWNERSHIP
Water Law and Its Application in Poland,
W80-00443 6E

OXIDATION
Environmental Pollution Control Alternatives: Municipal Wastewater,
W80-00544 5D

OXYGEN DEMAND
The Impact of Dredged Holes on Oxygen Demand in the Lower Bay, New York Harbor,
W80-00694 4C

OYSTERS
Effects of Artificial Eutrophication on the Metabolism of the Japanese Oyster Crassostrea Gigas,
W80-00792 5B

The Rock Oyster Saccostrea Glomerata as an Indicator of Trace Metals in Hong Kong,
W80-00793 5A

PACIFIC COAST REGION
Increasing Available Water Supplies Through Weather Modification and Desalination,
W80-00479 2B

PACIFIC OCEAN
Report of the ESCAP Regional Preparatory Meeting for the United Nations Water Conference.
W80-00406 6A

Estimates of Vertical Eddy Diffusion Through the Thermocline from Phytoplankton Nitrate Uptake Rates in the Mixed Layer of the Eastern Tropical Pacific,
W80-00630 2L

Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 2. Trust Territory of the Pacific Islands, Guam, American Samoa, and Northern Mariana Islands,
W80-00780 7C

PARAMETER ITERATION METHOD
Optimal Management of a Multireservoir Water Supply System,
W80-00583 4A

PARAMETRIC HYDROLOGY
Simulation Analyses: The Detailed Model,
W80-00561 2A

PASCO COUNTY
Evaluation of a Digital Model for Estuarine Water Quality Simulation in Waste Allocation Studies,
W80-00761 5B

PASSAIC RIVER (NJ)
Time Series Analysis of Ammonia in the Passaic River,
W80-00638 5C

PATH OF POLLUTANTS
A History of Mercury Levels in Swedish Fauna,
W80-00649 5A

Computation of the Advancement of Groundwater Pollution Due to Petroleum Products Originating from a Known Source of Contamination (Le Calcul de la Propagation de la Pollution des Eaux Souterraines par des Materiaux Huileux, Provenants D'une Source de la Pollution Connue),
W80-00720 5B

Evaluation of a Digital Model for Estuarine Water Quality Simulation in Waste Allocation Studies,
W80-00761 5B

PATHOGENIC BACTERIA
Survey of the Pollution in a Coastal Area of the Tyrrhenian Sea. Aerial Photography, Physico-Chemical and Microbiological Investigations and Mutagenic Monitoring,
W80-00796 5A

PATHOLOGY
Survey of Demersal Fish in Port Phillip Bay for Incidence of Neoplasia,
W80-00680 5A

PAVING
Stormwater-Runoff Data for a Commercial Area, Broward County, Florida,
W80-00772 4C

PEAK DISCHARGE
Flood Hazard Analyses, Little Ossipee River, Towns of Acton, Newfield and Shapleigh, Maine, York County.
W80-00535 2E

Flood Plain Information: Baton Rouge, Louisiana, No. 5, Cypress Bayou and Tributaries,
W80-00540 2E

PEAK DISCHARGE

Flood Plain Information: Baton Rouge, Louisiana, No 4, Hurricane Creek, Monte Sano Bayou and Tributaries,
W80-00541 2E

Flood Profiles Along the Cedar River, King County, Washington,
W80-00760 2E

Technique for Estimating the Magnitude and Frequency of Floods in St. Louis County, Missouri,
W80-00762 2E

Effects of Urbanization on the Magnitude and Frequency of Floods in Northeastern Illinois,
W80-00769 4C

Determination of Peak Discharge from Rainfall Data for Urbanized Basins, Wichita, Kansas,
W80-00774 6A

PERMEAMETERS

A Modified Permeameter for Measuring Hydraulic Conductivity of Soils,
W80-00614 2G

PERMITS

Water Law and Its Application in Poland,
W80-00443 6E

PESTICIDE RESIDUES

Efficacy, Uptake and Distribution of Different Herbicides in the Water Hyacinth,
W80-00519 5C

PESTICIDE TOXICITY

The Response of Coho Salmon and Guppies to 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) in Water,
W80-00651 5A

Toxicity of Fishery Chemicals to the Asiatic Clam, Corbicula Manilensis,
W80-00785 5A

PESTICIDES

Metabolism of Toxaphene by Aquatic Sediment and a Camphor-Degrading Pseudomonad,
W80-00511 5C

Toxicity of Fishery Chemicals to the Asiatic Clam, Corbicula Manilensis,
W80-00785 5A

PHAEOPHYTA

The Effect of Zinc on the Increase in Length of Five Species of Intertidal Fucales,
W80-00682 5B

PHOENIX

Survey of Swimming Pool Algae of the Phoenix, Arizona, Metropolitan Area,
W80-00506 5C

PHOSPHATES

The Effects of pH on the Aluminum, Iron and Calcium Phosphate Fractions of Lake Sediments,
W80-00588 2J

Trace Analysis of Phosphates in Small Aqueous Volumes,
W80-00589 5A

Evaluation of an Enzymatic Method for Orthophosphate Determination in Freshwaters,
W80-00625 5A

PHOSPHORUS

Phosphorus Cycling in Alaskan Coastal Tundra: A Hypothesis for the Regulation of Nutrient Cycling,
W80-00503 5C

PHOTOSYNTHESIS

The Effects of Emergence and Submergence on the Photosynthesis and Respiration of Marine Macrophytes,
W80-00514 5C

PHYSICAL PROPERTIES

Water Quality Investigation of Estuaries of Georgia, 1976,
W80-00553 2L

Comparison of Selected Cultural, Physical, and Water-Quality Characteristics of Lakes in Washington,
W80-00766 2H

PHYTOPLANKTON

The Influence of Fertilization on Phytoplankton in Ponds with Varied Development of Biocoenose,
W80-00509 5C

Phytoplankton Succession in Nutrient Enriched Experimental Ponds As Related to Changing Carbon, Nitrogen, and Phosphorus Conditions,
W80-00517 5C

Phytoplankton in the Coastal Waters of the Bothnian Bay Off Kemi,
W80-00518 5C

Mathematical Modeling of Phytoplankton Kinetics with Application to Two Alpine Lakes,
W80-00522 5C

The Production and Fate of Phytoplankton Size Fractions in the Plume of the Hudson River, New York Bight,
W80-00628 2L

The Effect of Cadmium and Lead on the Growth of Two Species of Marine Phytoplankton with Particular Reference to the Development of Tolerance,
W80-00676 5A

Phytoplankton in the Fox Chain of Lakes,
W80-00686 5C

PINELLAS COUNTY

Evaluation of a Digital Model for Estuarine Water Quality Simulation in Waste Allocation Studies,
W80-00761 5B

PIPE FLOW

Dividing-Flow Manifolds with Square-Edged Laterals,
W80-00582 8B

PIPELINES

Water for Domestic Use in Rural Areas - Thailand,
W80-00448 6D

PLANKTON

Mixing an Enclosed, 1300 Cubic Meter Water Column: Effects on the Planktonic Food Web,
W80-00672 5A

PLANNING

Socio-Economic Aspects of Urban Water Resources Planning and Management,
W80-00413 6A

Evaluation of Economic Benefits of Hydrological Services,
W80-00414 6B

Report on Community Water Supplies,
W80-00427 5F

The Design and Evaluation of Institutional Arrangements for Water Planning and Management,
W80-00431 6E

Water for the Thousand Millions,
W80-00432 6A

Long-Term Planning of Water Management,
W80-00434 6A

Rational Methods of Flood Control Planning in River Basin Development,
W80-00435 6A

Water Resources, Planning and Management: A Select Bibliography,
W80-00438 6A

Environmental Aspects of Pollution Control in Hungary,
W80-00441 6A

The Projects for the Increase of the Nile Yield with Special Reference to Jonglei Project,
W80-00447 4A

Water for Domestic Use in Rural Areas - Thailand,
W80-00448 6D

River Basin Management in the United Kingdom.
W80-00449 6A

Water Resources Development, and Management Planning in Arid Zones: Case History-Israel,
W80-00457 6A

The United States Experience in Flood Plain Management,
W80-00459 6F

Establishment of Quality Criteria for Water Use in Australia,
W80-00460 6E

On Role of Administrative, Economic and Technological Measures in Protection of Surface and Subterranean Water Against Contamination and Depletion,
W80-00465 6E

Hydrological Forecasting for Operational Planning and Management of Water Resources,
W80-00467 2E

Remote Sensing for Water Resources Management.
W80-00475 7B

Irrigation Management in Developing Countries: A Suggested Action Programme,
W80-00481 3F

Water USA: 1776-1976,
W80-00486 6E

Instream Flow Strategies for Washington,
W80-00531 6E

Instream Flow Strategies for California,
W80-00532 6E

Planning Theory: Multiobjectives,
W80-00556 6A

Planning Theory: The Role of Mathematical Models in Water Resources Planning,
W80-00557 6A

The Mathematical Programming Screening Model,
W80-00559 6A

Simulation Analyses: The Basic Model,
W80-00560 6A

Large Array of Wastewater Reuse Options for Pima County, Arizona,
W80-00646 6B

PLANT PHYSIOLOGY

The Effects of Emergence and Submergence on the Photosynthesis and Respiration of Marine Macrophytes,
W80-00514 5C

Efficacy, Uptake and Distribution of Different Herbicides in the Water Hyacinth,
W80-00519 5C

Unexpected Response to Vitamin B12 of Dominant Centric Diatoms from the Spring Bloom in the Gulf of Maine (Northeast Atlantic Ocean),
W80-00681 5C

Uptake of Cadmium by the Eelgrass Zostera Marina,
W80-00789 5A

POISONS
Toxic Substances in Water--The U.S. Experience.
W80-00456 5G

POLAND
Water Law and Its Application in Poland,
W80-00443 6E

Polish Research Program for System-Oriented Regional Management of Water Resources,
W80-00444 6A

POLICY
Basic Needs Strategy and Water Resources Policy,
W80-00418 6A

The United States Experience in Flood Plain Management,
W80-00459 6F

An Analysis of Values for Development of Recreational Policy,
W80-00500 6A

POLLUTANT IDENTIFICATION
A Comparison of Dynamic and Static Head Space and Solvent Extraction Techniques for the Determination of Trihalomethanes in Water,
W80-00617 5A

Evaluation of an Enzymatic Method for Orthophosphate Determination in Freshwaters,
W80-00625 5A

Chemical Pollutants of the New York Bight; Priorities for Research,
W80-00697 5C

POLYCHAETES
Uptake, Binding and Clearance of Divalent Cadmium in Glycera Dibranchiata (Annelida: Polychaeta),
W80-00664 5A

POLYCHLORINATED BIPHENYLS
Polychlorinated Biphenyls and Chlorinated Pesticides in Soils of the Everglades National Park and Adjacent Agricultural Areas,
W80-00618 5A

Hepatomas in Atlantic Tomcod Microgadus Tomcod (Walbaum) Collected in the Hudson River Estuary in New York,
W80-00675 5B

PONDS
The Influence of Fertilization on Phytoplankton in Ponds with Varied Development of Biocoenose,
W80-00509 5C

Water Quality in Channel Catfish Production Ponds,
W80-00619 5A

POPULATION
Can Planktovorous Fish Keep in Check Planktonic Crustacean Populations. A Test of Size-Efficiency Hypothesis in Typical Polish Lakes,
W80-00505 5C

The Diatomflora of a Small Stream Near Abisko (Swedish Lapland) and Its Annual Periodicity, Judged by Drift and Colonization,
W80-00516 5C

PORES
Relations Between Geometrical Properties of Glass Beads Media and Their Main Psi(Theta) Hysteresis Loops,
W80-00598 2G

Physical Components of the Diffusivity Coefficient,
W80-00754 2G

POROUS MEDIA
Relations Between Geometrical Properties of Glass Beads Media and Their Main Psi(Theta) Hysteresis Loops,
W80-00598 2G

Foundation Theories of Solute Transport in Porous Media: A Critical Review,
W80-00606 2A

Modeling Groundwater Flow Fields Containing Point Singularities: A Technique for Singularity Removal,
W80-00609 2F

Physical Components of the Diffusivity Coefficient,
W80-00754 2G

POTABLE WATER
Basic Needs Strategy and Water Resources Policy,
W80-00418 6A

Drinking Water Supply - A Field for UNICEF Assistance.
W80-00420 5D

Report on Community Water Supplies,
W80-00427 5F

POULTRY
Physical Condition of a Davidson Clay Loam after Five Years of Heavy Poultry Manure Applications,
W80-00620 2G

POWERPLANTS
A Seasonal Survey of Fish Populations in the Lower Medway Estuary, Kent, Based on Power Station Screen Samples,
W80-00650 5C

PRECIPITABLE WATER
Precipitable Water Over the United States. Volume II: Semimonthly Maxima,
W80-00698 2B

PRECIPITATION (ATMOSPHERIC)
World Water Balance and Water Resources of the Earth,
W80-00466 2A

Detailed Structure of pH in Hydrometeors,
W80-00616 2K

PRECIPITATION EXCESS
Secular Trend in Extreme Rainfalls,
W80-00735 2B

PREDATION
Can Planktovorous Fish Keep in Check Planktonic Crustacean Populations. A Test of Size-Efficiency Hypothesis in Typical Polish Lakes,
W80-00505 5C

PRICING
World Bank: Pricing as a Means of Controlling the Use of Water Resources.
W80-00411 6C

PRIMARY EFFLUENT
Long-Term Effects of Land Application of Domestic Wastewater: Vineland, New Jersey, Rapid Infiltration Site,
W80-00529 5E

PRIMARY PRODUCTIVITY
The Influence of Fertilization on Phytoplankton in Ponds with Varied Development of Biocoenose,
W80-00509 5C

Phytoplankton in the Coastal Waters of the Bothnian Bay Off Kemi,
W80-00518 5C

Mathematical Modeling of Phytoplankton Kinetics with Application to Two Alpine Lakes,
W80-00522 5C

PRIOR APPROPRIATION
Appropriative Water Rights and Efficient Allocation of Resources,
W80-00548 6E

PROBABILITY
Restriction of Supply and Risk in Water Supply Systems,
W80-00442 6C

PRODUCTIVITY
Experimental and Field Studies on Ecological Energetics of Asellus Aquaticus L. (Isopoda). Energy Budget of a Population in the Littoral Zone of Powsinskie Lake,
W80-00507 5C

Phytoplankton Succession in Nutrient Enriched Experimental Ponds As Related to Changing Carbon, Nitrogen, and Phosphorus Conditions,
W80-00517 5C

PROJECT PLANNING
Large Array of Wastewater Reuse Options for Pima County, Arizona,
W80-00646 6B

PROJECTS
Simulation Analyses: The Detailed Model,
W80-00561 2A

Engineering and Cost Parameters,
W80-00564 6B

PROTOZOA
Foraminifera in Brackish-Water Ponds Designed for Waste Control and Aquaculture Studies in North Carolina,
W80-00523 5C

PSEUDOMONAS
Metabolism of Toxaphene by Aquatic Sediment and a Camphor-Degrading Pseudomonad,
W80-00511 5C

PUBLIC HEALTH
Microbiological Water Quality in Relation to Public Health,
W80-00482 3C

PUMPING
Annual Water-Resources Review, White Sands Missile Range, New Mexico, 1978,
W80-00764 4D

RADIOACTIVE WASTE DISPOSAL
Recharge to Low-Level Radioactive-Waste Burial Trenches 11 Through 14, West Valley, New York,
W80-00775 5E

RADIOISOTOPES
Isotope Hydrology.
W80-00421 4A

RADIUM RADIOISOTOPES
Rate Controlling Processes in the Release of Radium-226 from Uranium Mill Tailings, I. Leaching Study,
W80-00600 5B

Rate Controlling Processes in the Release of Radium-226 from Uranium Mill Tailings, II. Kinetic Study,
W80-00601 5B

RAINBOW TROUT
Nephrocalcinosis in Rainbow Trout Salmo Gairdneri Richardson; The Effect of Exposure to Elevated CO2 Concentrations,
W80-00674 5A

RAINDROPS
A Wind Tunnel Investigation of the Rate of Evaporation of Large Water Drops Falling at Terminal Velocity in Air,
W80-00602 2B

RAINFALL
Predicting Hysteretic Effects in Evaporation From Bare Soil,
W80-00732 2D

Secular Trend in Extreme Rainfalls,
W80-00735 2B

Silver Concentration in Rainwater from Seeded and Nonseeded Florida Cumuli: 1973-1975 Results,
W80-00736 2B

Rainfall Interception by Eight Small Trees,
W80-00744 2I

RAINFALL INTENSITY
The Effect of Intense Fertilization on Migration of Nitrogen Compounds in Soil,
W80-00508 5C

RAINFALL-RUNOFF RELATIONSHIPS
Stormwater-Runoff Data for a Commercial Area, Broward County, Florida,
W80-00772 4C

Determination of Peak Discharge from Rainfall Data for Urbanized Basins, Wichita, Kansas,
W80-00774 6A

RANDOM SAMPLE SIZE
Note on the Distribution of Flood Maxima for Random Sample Size,
W80-00611 2E

RAPID INFILTRATION SYSTEMS
Long-Term Effects of Land Application of Domestic Wastewater: Vineland, New Jersey, Rapid Infiltration Site,
W80-00529 5E

REAERATION
Estimating the Gas and Dye Quantities for Modified Tracer Technique Measurements of Stream Reaeration Coefficients,
W80-00773 5B

REAERATION COEFFICIENT
Estimating the Gas and Dye Quantities for Modified Tracer Technique Measurements of Stream Reaeration Coefficients,
W80-00773 5B

RECHARGE PONDS
Effects of In-Transit Water on Groundwater Mounds Beneath Circular and Rectangular Recharge Areas,
W80-00610 2F

RECREATION
Impacts of a Large Recreational Development on Water Quality in a Semi-Primitive Environment,
W80-00498 5C

RECREATION DEMAND
An Analysis of Values for Development of Recreational Policy,
W80-00500 6A

Socio-Economic Relationships for Water-Based Recreation Involvement in Indiana,
W80-00636 6B

RECYCLING
Wastewater as a Source of Nutrients and Water for Hydroponic Crop Production in Arid Regions,
W80-00642 5F

REFRACTION (WATER WAVES)
Tillamook Bay Entrance Refraction Study, Tillamook, Oregon,
W80-00501 8A

REGIONAL ANALYSIS
A Comparative Analysis of Multi-Source Water Supply Data for Pima County, Arizona,
W80-00644 6D

Large Array of Wastewater Reuse Options for Pima County, Arizona,
W80-00646 6B

REGIONAL DEVELOPMENT
International River Basin Co-Operation: The Lessons from Experience,
W80-00430 6A

Colorado River Basin Water Problems: How to Reduce Their Impact,
W80-00545 6E

REGIONAL PLANNING
Report of the ESCAP Regional Preparatory Meeting for the United Nations Water Conference.
W80-00406 6A

Report of the Regional Preparatory Meeting of the Countries of Latin America and the Caribbean for the United Nations Water Conference,
W80-00407 6A

Economic Commission for Europe. Regional Report,
W80-00408 6A

Economic Commission for Africa, Regional Report,
W80-00409 6A

Report of the Economic Commission for Western Asia Regional Preparatory Meeting.
W80-00410 6A

The Water Resources of Latin America Regional Report,
W80-00415 6A

Polish Research Program for System-Oriented Regional Management of Water Resources,
W80-00444 6A

Finnish Experiences in Water-Resources Planning and Management Policy,
W80-00451 6A

River Basin Planning in Canada,
W80-00472 6A

REGRESSION ANALYSIS
Experimental and Field Studies on Ecological Energetics of Asellus Aquaticus L. (Isopoda). Energy Budget of a Population in the Littoral Zone of Powsinskie Lake,
W80-00507 5C

Technique for Estimating the Magnitude and Frequency of Floods in St. Louis County, Missouri,
W80-00762 2E

REGRESSIVE TAXES
Federal Tax Incentives for Private Environmental Planning,
W80-00496 6E

REGULATED FLOW
Flood Profiles Along the Cedar River, King County, Washington,
W80-00760 2E

REGULATION
Water Law and Its Application in Poland,
W80-00443 6E

Coastal Zone Management In The United States,
W80-00478 6E

REMOTE SENSING
Remote Sensing for Water Resources Management.
W80-00475 7B

A DMSP Near IR Sensor for Cloud/Snow Discrimination,
W80-00570 7B

The United States Environmental Satellite Data Archives,
W80-00571 7B

Satellite-Derived River Basin Snow-Cover Percentages: A New Data Base for Hydrologists,
W80-00572 7B

RESEARCH AND DEVELOPMENT
Policy and Organization of Water Research in the United Kingdom.
W80-00439 6A

Polish Research Program for System-Oriented Regional Management of Water Resources,
W80-00444 6A

RESEARCH EQUIPMENT
Temperature-Monitoring and Safety-Control Device,
W80-00783 5A

Modified Venture Suction Sampler for Collecting Asiatic Clams,
W80-00787 5A

RESEARCH PRIORITIES
Policy and Organization of Water Research in the United Kingdom.
W80-00439 6A

RESERVOIR PROJECTS
Planning Status Report, Water Resources Appraisals for Hydroelectric Licensing: Lower Arkansas River Basin-Arkansas, Colorado, Kansas, New Mexico, Oklahoma and Texas,
W80-00533 6D

RESERVOIR RELEASES
Computerized Optimization of Water Releases from Reservoirs,
W80-00445 4A

RESERVOIR STORAGE
Instream Flow Strategies for Washington,
W80-00531 6E

Instream Flow Strategies for California,
W80-00532 6E

RESERVOIRS
The Environmental Impacts of the Aswan High Dam,
W80-00446 5C

Instream Flow Strategies for Washington,
W80-00531 6E

Instream Flow Strategies for California,
W80-00532 6E

Optimal Management of a Multireservoir Water Supply System,
W80-00583 4A

Heat and Mass Exchange Coefficients for Open Water Surfaces,
W80-00714 2D

RESIDENTIAL
An Analysis of Residential Demand for Water Using Micro Time-Series Data,
W80-00599 6D

RESIDUAL WASTE MANAGEMENT
Integration of Residual Waste Management with Water Quality Management,
W80-00526 6E

RESIDUALS
Integration of Residual Waste Management with Water Quality Management,
W80-00526 6E

RESOURCE ALLOCATION
Basic Needs Strategy and Water Resources Policy,
W80-00418 6A

RESPIRATION
The Effects of Emergence and Submergence on the Photosynthesis and Respiration of Marine Macrophytes,
W80-00514 5C

REVERSE OSMOSIS
Development of a Chlorine Resistant Reverse Osmosis Membrane and Porous Membrane Supports,
W80-00487 3A

REVIEWS
Foundation Theories of Solute Transport in Porous Media: A Critical Review,
W80-00606 2A

RICE
Conservation Bench Terraces for Rice in a Subhumid Climate,
W80-00595 3F

RIO COLORADO (ARGENTINA)
Applied Water Resource Systems Planning,
W80-00554 6A

Planning for the Rio Colorado: An Overview,
W80-00558 6A

Simulation Analyses: The Basic Model,
W80-00560 6A

Simulation Analyses: The Detailed Model,
W80-00561 2A

Outputs of the Models,
W80-00565 6A

RIO COLORADO BASIN (ARGENTINA)
The Rio Colorado Basin,
W80-00555 6A

RIO GRANDE RIVER
Landsat-Derived Snow Cover as a Forecast Tool in the Rio Grande Basin in Colorado,
W80-00573 2C

RIPARIAN HABITAT
Floral and Faunal Changes in Lowland Hardwood Forests in Missouri Resulting from Channelization, Drainage, and Impoundment,
W80-00528 6G

RISKS
Restriction of Supply and Risk in Water Supply Systems,
W80-00442 6C

RIVER BASIN DEVELOPMENT
Environmental Issues in River Basin Development,
W80-00433 2A

Rational Methods of Flood Control Planning in River Basin Development,
W80-00435 6A

River Basin Management in the United Kingdom.
W80-00449 6A

The Long-Term National Programme for River Basin Development, Basis of the Water Management Policy in Romania,
W80-00450 6A

River Basin Planning in Canada,
W80-00472 6A

The Mathematical Programming Sequencing Model,
W80-00562 6A

Outputs of the Models,
W80-00565 6A

RIVER BASINS
Economic Commission for Africa, Regional Report,
W80-00409 6A

Work of the International Law Commission on the Law of the Non-Navigational Uses of International Watercourses.
W80-00423 6E

Rehabilitation of Catchment Areas in Mountain Regions,
W80-00469 4A

Inter Basin Water Transfers in South Africa,
W80-00483 6D

Planning for the Rio Colorado: An Overview,
W80-00558 6A

RIVER FLOW
Hydrological Forecasting for Operational Planning and Management of Water Resources,
W80-00467 2E

Ground Water Replenishment from Riverflow,
W80-00604 2F

Extension of River Flow Records in Argentina from Long Tree-Ring Chronologies,
W80-00731 2E

RIVER SAJO (HUNGARY)
An Effort for Modelling the Transport of Micropollutants in Rivers,
W80-00702 5B

RIVER SYSTEMS
The Mathematical Programming Screening Model,
W80-00559 6A

Simulation Analyses: The Basic Model,
W80-00560 6A

RIVERS
U.S. Inland Water Transportation,
W80-00473 6E

The Rio Colorado Basin,
W80-00555 6A

Isotopic Composition of River Runoff on the U.S. East Coast: Evaluation of Stable Isotope Versus Salinity Plots for Coastal Water Mass Identification,
W80-00607 2L

An Analysis of the Processes of River Bank Erosion,
W80-00612 2J

Weak and Strong Acids in the Surface Waters of the Tovdal Region in S. Norway,
W80-00624 2K

Importance of Lake-River Interaction on Seasonal Patterns in the General Circulation of Kamloops Lake, British Columbia,
W80-00631 2H

An Effort for Modelling the Transport of Micropollutants in Rivers,
W80-00702 5B

Effects of the Construction of a Broad Waterway on the Water Quality of the Doubs (Effets de la Canalisation a Grand Gabarit sur la Qualite des Eaux du Doubs),
W80-00704 5B

The Biocenotic Model,
W80-00707 5B

The Use and Limitations of a Two-Dimensional Mixing Model for Rivers,
W80-00708 5B

ROCKY MOUNTAIN REGION
Increasing Available Water Supplies Through Weather Modification and Desalination,
W80-00479 2B

ROMANIA
The Long-Term National Programme for River Basin Development, Basis of the Water Management Policy in Romania,
W80-00450 6A

ROUTING
A Storage Routing Model Based on Catchment Geomorphology,
W80-00590 2E

RUHR AUTHORITY (WEST GERMANY)
Examples of the Organization of Self-Administration in the Water Economy of the Federal Republic of Germany,
W80-00470 6E

RUHR DISTRICT (WEST GERMANY)
Examples of the Organization of Self-Administration in the Water Economy of the Federal Republic of Germany,
W80-00470 6E

RUHR VALLEY ASSOCIATION (WEST GERMANY)
Examples of the Organization of Self-Administration in the Water Economy of the Federal Republic of Germany,
W80-00470 6E

RUNNING WATERS
The Diatomflora of a Small Stream Near Abisko (Swedish Lapland) and Its Annual Periodicity, Judged by Drift and Colonization,
W80-00516 5C

RUNOFF
Guidelines for Urban Development in Louisiana's Coastal Wetlands,
W80-00547 4C

Some Dimensional Considerations in the Unit Hydrograph Theory,
W80-00591 2E

Influence of Surface Roughness and Clod Size and Stability on Soil and Water Losses,
W80-00593 2J

Sediment and Nutrient Yield from Residential Construction Sites,
W80-00622 5B

Hydrological and Geochemical Mass Balance in Small Forested and Agricultural Basins,
W80-00703 2A

An Application Runoff Model Strategy for Ungaged Watersheds,
W80-00728 2E

Influence of Turbulence on the Accuracy of Discharge Measurements in Natural Streamflows,
W80-00745 2E

A Statistical Method for Modelling the Fate of Rainfall in a Tropical Rainforest Catchment,
W80-00748 2E

A Finite-Element Distributed Catchment Model, II. Application to Real Catchments,
W80-00749 2E

Water-Quality Assessment of Runoff from a Rural Highway Bridge Near Tallahassee, Florida,
W80-00767 5B

RUNOFF FORECASTING
Use of Water Quality Variables for Estimation of Water Quantity Characteristics,
W80-00709 2A

RURAL AREAS
Water, Women, and Development,
W80-00416 6A

Water for the Thousand Millions,
W80-00432 6A

Water for Domestic Use in Rural Areas - Thailand,
W80-00448 6D

Technique for Estimating the Magnitude and Frequency of Floods in St. Louis County, Missouri,
W80-00762 2E

RURAL SOCIOLOGY
Water for the Thousand Millions,
W80-00432 6A

SALINE SOILS
Simulation Model of the Evolution of the Chemical Composition of a Mineral-Solution System and its Applications (Modele de Simulation de L'Evolution de la Composition Chimique d'un Systeme Mineraux-Solution et ses Applications),
W80-00721 5A

SALINE WATER ENCROACHMENT
Ground-Water Management Techniques for the Control of Salt-Water Encroachment in Gulf-Coast Aquifers, A Summary Report,
W80-00490 2F

SALINE WATER INTRUSION
Ground Water in Dale Valley, New York,
W80-00768 4B

SALINITY
On the Growth of Instabilities in Groundwater Due to Temperature and Salinity Gradients,
W80-00605 2F

Impact of Irrigation Water Salinity on Soil Runoff Water and Groundwater in Missouri,
W80-00635 3C

Measurement of Apparent Electrical Conductivity of Soils by an Electromagnetic Induction Probe to Aid Salinity Surveys,
W80-00750 2G

Inexpensive Four-Electrode Probe for Monitoring Soil Salinity,
W80-00751 2G

A Compact, Low-Cost Circuit for Reading Four-Electrode Salinity Sensors,
W80-00752 2G

The Use of the Salinity Maximum of the Equatorial Undercurrent for Estimating Nutrient Enrichment and Primary Production in the Gulf of Guinea,
W80-00781 5C

SAMOA ISLANDS
Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 2. Trust Territory of the Pacific Islands, Guam, American Samoa, and Northern Mariana Islands,
W80-00780 7C

SAMPLING
Note on the Distribution of Flood Maxima for Random Sample Size,
W80-00611 2E

A Water Quality Study of a Stretch of the River Tigris,
W80-00623 5A

Modified Venture Suction Sampler for Collecting Asiatic Clams,
W80-00787 5A

SAN BENITO COUNTY
Digital Model of the Hollister Valley Ground-Water Basin, San Benito County, California,
W80-00756 6A

SAN BERNARDINO COUNTY (CA)
Ground-Water Conditions and Potential for Artificial Recharge in Lucerne Valley, San Bernardino County, California,
W80-00763 4B

SANDS
The Impact of Dredged Holes on Oxygen Demand in the Lower Bay, New York Harbor,
W80-00694 4C

SANDSTONES
Soil Water in Coarse Fragments,
W80-00592 2G

SANITATION
Drinking Water Supply - A Field for UNICEF Assistance.
W80-00420 5D

Report on Community Water Supplies,
W80-00427 5F

SATELLITES (ARTIFICIAL)
Remote Sensing for Water Resources Management.
W80-00475 7B

The United States Environmental Satellite Data Archives,
W80-00571 7B

NASA Mapping Projects (Summary),
W80-00578 7C

SAUDI ARABIA
Development of Water Resources and its Influence on the Ecology of Saudi Arabia,
W80-00640 6G

SAUGERS
The Importance of Tributary Streams to the Reproduction of Catostomios and Sauger,
W80-00637 6G

SCANDINAVIA
Deterioration of Water Quality Due to Long Range Transport of Air Pollution,
W80-00458 5G

SCIENTIFIC PERSONNEL
Technical Cooperation Among Developing Countries with Regard to Water Resources Development.
W80-00425 6E

SCREENING MODEL
The Mathematical Programming Screening Model,
W80-00559 6A

Simulation Analyses: The Basic Model,
W80-00560 6A

Outputs of the Models,
W80-00565 6A

SCREENING MODELS
Screening Objectives and Uncertainties in Water Resources Planning,
W80-00551 6A

SCULPINS
Sensitivity of Alaskan Freshwater and Anadromous Fishes to Prudhoe Bay Crude Oil and Benzene,
W80-00660 5A

SEA ICE
Glaciological Data: Workshop on Snow Cover and Sea Ice Data.
W80-00566 2C

Data Sources and Sea Ice Products of Fleet Weather Facility/Joint Ice Center, Suitland,
W80-00568 2C

Mapping and Archiving of Canadian Sea Ice Data,
W80-00569 7C

An Arctic Sea Ice Data Set, 1901-1956,
W80-00576 2C

Inadequacies in Archived Sea Ice Data,
W80-00577 2C

Sea Ice Ridging Over the Alaskan Continental Shelf,
W80-00738 2C

SEA LEVEL
Low-Frequency Sea Level and Current Fluctuations Along the Coast of Northwest Italy,
W80-00742 2L

SEA LEVEL FLUCTUATION
Low-Frequency Sea Level and Current Fluctuations Along the Coast of Northwest Italy,
W80-00742 2L

SEA URCHINS
Toxic Effects of Aqueous Extracts of Ekofisk Crude Oil, Crude Oil Fractions, and Commercial Oil Products on the Development of Sea Urchin Eggs,
W80-00798 5A

SEASONAL
Seasonal Changes in the Spectral Composition of Downwelling Irradiance in Lake Kinneret (Israel),
W80-00629 2H

A Seasonal Survey of Fish Populations in the Lower Medway Estuary, Kent, Based on Power Station Screen Samples,
W80-00650 5C

The Effects of Pollution-Induced Oxygen Deficiency on the Benthos in Elefsis Bay, Greece,
W80-00690 5C

The Temperature Preference of the Three-Spined Stickleback, Gasterosteus Aculeatus L. (Pisces), Collected at Different Seasons,
W80-00797 5A

SECONDARY TREATMENT
Reduction of Nonionic Surfactant Toxicity by Secondary Treatment,
W80-00678 5A

SEDIMENT
The Effects of Pollution-Induced Oxygen Deficiency on the Benthos in Elefsis Bay, Greece, W80-00690 5C

SEDIMENT DISTRIBUTION
Textural Properties of Surficial Sediments of Lower Bay of New York Harbor, W80-00696 2J

SEDIMENT YIELD
Sediment Yield and Land Use in Tropical Catchments, W80-00746 2J

SEDIMENTATION CONTROL
Urban Stormwater Pollution: An Investigation of the Problem and Its Control, W80-00525 5B

SEDIMENTS
Degradation of Selected Polycyclic Aromatic Hydrocarbons in Coastal Sediments: Importance of Microbes and Polychaete Worms, W80-00613 5A

Sediment and Nutrient Yield from Residential Construction Sites, W80-00622 5B

Textural Properties of Surficial Sediments of Lower Bay of New York Harbor, W80-00696 2J

SEEPAGE
Chemical Seepage from a Tail Water Recovery Pit to Adjacent Ground Water, W80-00621 5B

SELF-PURIFICATION
The Biocenotic Model, W80-00707 5B

SEPTIC TANKS
Individual Non-Urban Wastewater Treatment and Management Alternatives: Task B: Summary of Alternative On-Site Wastewater Treatment and Disposal Methods, Region J, N.C. W80-00534 5D

SEQUENCING MODEL
The Mathematical Programming Sequencing Model, W80-00562 6A

Outputs of the Models, W80-00565 6A

SEWAGE DISPOSAL
Report on Community Water Supplies, W80-00427 5F

SEWAGE EFFLUENTS
Foraminifera in Brackish-Water Ponds Designed for Waste Control and Aquaculture Studies in North Carolina, W80-00523 5C

Transport of Viruses Through Organic Soils and Sediments, W80-00584 5E

Effects of Treated Effluent on a Natural Marsh, W80-00677 5B

Responses of Marine Fouling Communities to Sewage Abatement in Kaneohe Bay, Oahu, Hawaii, W80-00791 5B

The Use of Chironomid Pupal Exuviae in the Surveillance of Sewage Pollution Within a Drainage System, W80-00794 5A

SEWAGE SLUDGE
Potential Ground Water Pollution from Sewage Sludge Application on Agricultural Land, W80-00489 5G

SEWAGE TREATMENT
Main Trends in Treatment of Municipal and Industrial Sewage in the USSR, W80-00464 5D

Examples of the Organization of Self-Administration in the Water Economy of the Federal Republic of Germany, W80-00470 6E

Microbiological Water Quality in Relation to Public Health, W80-00482 3C

Environmental Pollution Control Alternatives: Municipal Wastewater, W80-00544 5D

SEWER SYSTEMS
Urban Stormwater Pollution: An Investigation of the Problem and Its Control, W80-00525 5B

SHALES
Soil Water in Coarse Fragments, W80-00592 2G

SHAPLEIGH (ME)
Flood Hazard Analyses, Little Ossipee River, Towns of Acton, Newfield and Shapleigh, Maine, York County. W80-00535 2E

SHARKS
Study of Metal Contents of Elasmobranch Fishes: Part I-Metal Concentration in the Muscle Tissues of a Dogfish, Squalus Mitsukurii, W80-00685 5A

SHRIMP
Integration of Thermal and Food Processing Residuals into a System for Commercial Culture of Freshwater Shrimp. (Power Plant Waste Heat Utilization in Aquaculture)., Volume II, W80-00497 3C

SILICA
Growth and Competition of the Marine Diatoms Phaeodactylum Tricornutum and Thalassiosira Pseudonana, I. Nutrient Effects, W80-00515 5C

SILURIAN DOLOMITE AQUIFER (WI)
Contamination Potential in the Silurian Dolomite Aquifer, Eastern Wisconsin, W80-00757 5B

SILVER CONCENTRATION
Silver Concentration in Rainwater from Seeded and Nonseeded Florida Cumuli: 1973-1975 Results, W80-00736 2B

SILVER IODIDE
Silver Concentration in Rainwater from Seeded and Nonseeded Florida Cumuli: 1973-1975 Results, W80-00736 2B

SIMULATION ANALYSIS
Application of the Aquatic Model Cleaner to a Stratified Reservoir System, W80-00520 5C

Mathematical Modeling of Phytoplankton Kinetics with Application to Two Alpine Lakes, W80-00522 5C

Planning Theory: The Role of Mathematical Models in Water Resources Planning, W80-00557 6A

Simulation Analyses: The Basic Model, W80-00560 6A

Simulation Analyses: The Detailed Model, W80-00561 2A

Outputs of the Models, W80-00565 6A

Laboratory Simulation of the Gyre in the Alboran Sea, W80-00743 2L

SITES
The Rio Colorado Basin, W80-00555 6A

Drainage Areas of the Twelvepole Creek Basin, West Virginia, Big Sandy River Basin, West Virginia, Tug Fork Basin, Virginia, Kentucky, West Virginia, W80-00765 7C

SIZE
A Survey of the Biota, Environment and Use for Recreation of Twelve Lakes in Snowdonia, W80-00699 5C

SLAPY RESERVOIR
Application of the Aquatic Model Cleaner to a Stratified Reservoir System, W80-00520 5C

SLIDELL (LA)
Flood Plain Information: Bayou Bonfouca-Bayou Vincent W-14 Main Diversion Canal Doubloon Branch-French Branch, Slidell, Louisiana and Vicinity, W80-00536 2E

SLUDGE
Environmental Pollution Control Alternatives: Municipal Wastewater, W80-00544 5D

SLUDGE TREATMENT
Environmental Pollution Control Alternatives: Municipal Wastewater, W80-00544 5D

SNOW
Glaciological Data: Workshop on Snow Cover and Sea Ice Data. W80-00566 2C

Snow and Ice Data Sets for Climate and Water Resource Studies with Particular Reference to North America, W80-00567 2C

A DMSP Near IR Sensor for Cloud/Snow Discrimination, W80-00570 7B

SNOW COVER
Satellite-Derived River Basin Snow-Cover Percentages: A New Data Base for Hydrologists, W80-00572 7B

Landsat-Derived Snow Cover as a Forecast Tool in the Rio Grande Basin in Colorado, W80-00573 2C

Archiving and Mapping of Canadian Snow Cover Data, W80-00574 2C

Accuracy of Snow and Ice Monitoring, W80-00575 2C

SNOW GOOSE
Lead and Mercury in Lesser Snow Geese Wintering in Louisiana, W80-00799 5A

SNOW SURVEYS
Satellite-Derived River Basin Snow-Cover Percentages: A New Data Base for Hydrologists, W80-00572 7B

SNOWMELT
Hydrological Forecasting for Operational Planning and Management of Water Resources, W80-00467 2E

SOCIAL IMPACTS
Summary: Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00633 6G

SOCIAL NEEDS
The World's Water in a Human Perspective.
W80-00453 6A

SOCIAL PARTICIPATION
Socio-Economic Relationships for Water-Based Recreation Involvement in Indiana,
W80-00636 6B

SOCIAL VALUES
An Analysis of Values for Development of Recreational Policy,
W80-00500 6A

SOCIALISM
Water Law and Its Application in Poland,
W80-00443 6E

SOCIOECONOMIC RELATIONSHIPS
Socio-Economic Relationships for Water-Based Recreation Involvement in Indiana,
W80-00636 6B

SOCKEYE SALMON
The Response of Coho Salmon and Guppies to 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) in Water,
W80-00651 5A

SOIL CHEMICAL PROPERTIES
Significance of Sorption Properties of Soils in Predicting the Migration of Nitrogen Compounds into Natural Waters,
W80-00510 5C

SOIL EROSION
Rehabilitation of Catchment Areas in Mountain Regions,
W80-00469 4A

Microbial Effects on Soil Erodibility,
W80-00594 2J

SOIL PHYSICAL PROPERTIES
Physical Condition of a Davidson Clay Loam after Five Years of Heavy Poultry Manure Applications,
W80-00620 2G

SOIL PROPERTIES
A Modified Permeameter for Measuring Hydraulic Conductivity of Soils,
W80-00614 2G

SOIL SURFACES
Influence of Surface Roughness and Clod Size and Stability on Soil and Water Losses,
W80-00593 2J

SOIL TYPES
Significance of Sorption Properties of Soils in Predicting the Migration of Nitrogen Compounds into Natural Waters,
W80-00510 5C

SOIL WATER
Soil Water in Coarse Fragments,
W80-00592 2G

Absorption of Water by Soil: The Constant Flux Boundary Condition,
W80-00596 2G

Use of Fluorescent Dyes to Mark the Pathways of Solute Movement Through Soils Under Leaching Conditions: 2. Field Experiments,
W80-00615 2G

Impact of Irrigation Water Salinity on Soil Runoff Water and Groundwater in Missouri,
W80-00635 3C

SOIL WATER MOVEMENT
Use of Fluorescent Dyes to Mark the Pathways of Solute Movement Through Soils Under Leaching Conditions: 2. Field Experiments,
W80-00615 2G

Simulation Model of the Evolution of the Chemical Composition of a Mineral-Solution System and its Applications (Modele de Simulation de L'Evolution de la Composition Chimique d'un Systeme Mineraux-Solution et ses Applications),
W80-00721 5A

SOILS
Predicting Hysteretic Effects in Evaporation From Bare Soil,
W80-00732 2D

Measurement of Apparent Electrical Conductivity of Soils by an Electromagnetic Induction Probe to Aid Salinity Surveys,
W80-00750 2G

Inexpensive Four-Electrode Probe for Monitoring Soil Salinity,
W80-00751 2G

A Compact, Low-Cost Circuit for Reading Four-Electrode Salinity Sensors,
W80-00752 2G

A Galerkin in Time, Linearized Finite Element Model of 2-Dimensional Unsaturated Porous Media Drainage,
W80-00753 2G

SOLUTES
Foundation Theories of Solute Transport in Porous Media: A Critical Review,
W80-00606 2A

Use of Fluorescent Dyes to Mark the Pathways of Solute Movement Through Soils Under Leaching Conditions: 2. Field Experiments,
W80-00615 2G

SOUTH AFRICA
Microbiological Water Quality in Relation to Public Health,
W80-00482 3C

Inter Basin Water Transfers in South Africa,
W80-00483 6D

Pollution Control in the Mining Industry in South Africa,
W80-00484 5G

SOUTH CAROLINA
Water Resources Data for South Carolina, Water Year 1978.
W80-00778 7C

SOUTHWEST GEORGIA
A Preliminary Appraisal of the Impact of Agriculture on Ground-Water Availability in Southwest Georgia,
W80-00770 4B

SOVIET UNION
Main Trends in Treatment of Municipal and Industrial Sewage in the USSR,
W80-00464 5D

On Role of Administrative, Economic and Technological Measures in Protection of Surface and Subterranean Water Against Contamination and Depletion,
W80-00465 6E

The Main Directions of Hydrogeological Investigations for the Substantiation of Artificial Recharge,
W80-00468 2A

SPATIAL DISTRIBUTION
Source Schematization Effects on Farfield Results,
W80-00723 2H

SPAWNING
The Importance of Tributary Streams to the Reproduction of Catostomios and Sauger,
W80-00637 6G

SPECIES DIVERSITY
A Seasonal Survey of Fish Populations in the Lower Medway Estuary, Kent, Based on Power Station Screen Samples,
W80-00650 5C

Effects of Acid Mine Drainage on a Southwestern Pennsylvania Stream,
W80-00684 5A

Responses of Marine Fouling Communities to Sewage Abatement in Kaneohe Bay, Oahu, Hawaii,
W80-00791 5B

SPLEEN
The Role of Melano-Macrophage Centres in Iron Storage in Normal and Diseased Fish,
W80-00683 5A

SPOT
Thermal Shock Resistance of Spot (Leiostomus Xanthurus) After Acclimation to Constant or Cycling Temperature,
W80-00652 5C

ST. LAWRENCE BASIN
Boundary Waters Management,
W80-00480 6E

ST. LOUIS COUNTY (MO)
Technique for Estimating the Magnitude and Frequency of Floods in St. Louis County, Missouri,
W80-00762 2E

STABLE ISOTOPES
Isotope Hydrology.
W80-00421 4A

STAGE-DISCHARGE RELATIONS
Flood Hazard Analyses, Little Ossipee River, Towns of Acton, Newfield and Shapleigh, Maine, York County.
W80-00535 2E

Flood Plain Information: Ohio River, Hancock County, Kentucky,
W80-00537 2E

Flood Plain Information: Ohio River, Boone County, Kentucky,
W80-00539 2E

STATE GOVERNMENTS
Coastal Zone Management In The United States,
W80-00478 6E

STATISTICAL METHODS
Statistical Terminology: Definitions and Interpretation for Flood Peak Estimation,
W80-00729 2E

STATISTICAL MODELS
Time Series Analysis of Ammonia in the Passaic River,
W80-00638 5C

STATISTICAL TERMINOLOGY
Statistical Terminology: Definitions and Interpretation for Flood Peak Estimation,
W80-00729 2E

STATISTICS
Statistical Terminology: Definitions and Interpretation for Flood Peak Estimation,
W80-00729 2E

Secular Trend in Extreme Rainfalls,
W80-00735 2B

STEADY STATE CONDITIONS
Evaluation of a Digital Model for Estuarine Water Quality Simulation in Waste Allocation Studies,
W80-00761 5B

STICKLEBACKS
Sensitivity of Alaskan Freshwater and Anadromous Fishes to Prudhoe Bay Crude Oil and Benzene,
W80-00660 5A

The Temperature Preference of the Three-Spined Stickleback, Gasterosteus Aculeatus L. (Pisces), Collected at Different Seasons,
W80-00797 5A

STOCHASTIC PROCESSES
Optimal Management of a Multireservoir Water Supply System,
W80-00583 4A

Time Series Analysis of Ammonia in the Passaic River,
W80-00638 5C

STORAGE
A Storage Routing Model Based on Catchment Geomorphology,
W80-00590 2E

Effects of In-Transit Water on Groundwater Mounds Beneath Circular and Rectangular Recharge Areas,
W80-00610 2F

STORM RUNOFF
Stormwater-Runoff Data for a Commercial Area, Broward County, Florida,
W80-00772 4C

Determination of Peak Discharge from Rainfall Data for Urbanized Basins, Wichita, Kansas,
W80-00774 6A

STORMS
Flood Plain Information: Bayou Bonfouca-Bayou Vincent W-14 Main Diversion Canal Doubloon Branch-French Branch, Slidell, Louisiana and Vicinity,
W80-00536 2E

STORMWATER RUNOFF
Urban Stormwater Pollution: An Investigation of the Problem and Its Control,
W80-00525 5B

STRAIT OF GIBRALTER
Laboratory Simulation of the Gyre in the Alboran Sea,
W80-00743 2L

STRATIFIED FLOW
Laboratory Simulation of the Gyre in the Alboran Sea,
W80-00743 2L

STREAM NETWORKS
Drainage Network Power,
W80-00725 8E

STREAMFLOW
Instream Flow Strategies for Washington,
W80-00531 6E

Instream Flow Strategies for California,
W80-00532 6E

Simulation Analyses: The Detailed Model,
W80-00561 2A

Streamflow Generation in a Forested Watershed, New Zealand,
W80-00724 2E

Influence of Turbulence on the Accuracy of Discharge Measurements in Natural Streamflows,
W80-00745 2E

Statistical Summaries of Arizona Streamflow Data,
W80-00771 2E

STREAMFLOW DATA
Engineering and Cost Parameters,
W80-00564 6B

STREAMFLOW GENERATION
Streamflow Generation in a Forested Watershed, New Zealand,
W80-00724 2E

STREAMS
Drainage Network Power,
W80-00725 8E

Drainage Areas of the Twelvepole Creek Basin, West Virginia, Big Sandy River Basin, West Virginia, Tug Fork Basin, Virginia, Kentucky, West Virginia,
W80-00765 7C

Estimating the Gas and Dye Quantities for Modified Tracer Technique Measurements of Stream Reaeration Coefficients,
W80-00773 5B

STRUCTURAL GEOLOGY
Application of Geoscientific Knowledge to Evaluation of Land and Water Resources in Some Desert Areas of Egypt,
W80-00639 6B

SUBHUMID CLIMATES
Conservation Bench Terraces for Rice in a Subhumid Climate,
W80-00595 3F

SUBSIDENCE
On Water Reuse Promotion Measures,
W80-00477 6F

SUBSURFACE WATERS
On the Theoretical Basis of Modelling the Quality of Surface and Subsurface Waters,
W80-00700 5B

SUCCESSION
Structure and Succession in Rocky Algal Communities of a Temperate Intertidal System,
W80-00504 5C

Phytoplankton Succession in Nutrient Enriched Experimental Ponds As Related to Changing Carbon, Nitrogen, and Phosphorus Conditions,
W80-00517 5C

SUCKERS
The Importance of Tributary Streams to the Reproduction of Catostomios and Sauger,
W80-00637 6G

SUDAN
The Projects for the Increase of the Nile Yield with Special Reference to Jonglei Project,
W80-00447 4A

SUNFISHES
Growth Rates and Temperature Selection of Bluegill, Lepomis Macrochirus,
W80-00654 5C

SURF SCOTER DUCK
Trace Metals in Seaducks of the Fraser River Delta Intertidal Area, British Columbia,
W80-00657 5A

SURFACE-GROUNDWATER RELATIONSHIP
Sources, Transportation and Utilization of Dissolved Organic Matter in Groundwater and Streams,
W80-00530 2F

SURFACE-GROUNDWATER RELATIONSHIPS
Contamination Potential in the Silurian Dolomite Aquifer, Eastern Wisconsin,
W80-00757 5B

SURFACE WATERS
Isotope Hydrology.
W80-00421 4A

Assessment of Water Resources: Networks, Surveys, Services, and Related Facilities: Present Status and Requirements by 2000.
W80-00426 6A

On the Theoretical Basis of Modelling the Quality of Surface and Subsurface Waters,
W80-00700 5B

Water Resources Data for Wisconsin, Water Year 1978.
W80-00777 7C

Water Resources Data for South Carolina, Water Year 1978.
W80-00778 7C

Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 1. Hawaii.
W80-00779 7C

Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 2. Trust Territory of the Pacific Islands, Guam, American Samoa, and Northern Mariana Islands,
W80-00780 7C

SURFACTANTS
Reduction of Nonionic Surfactant Toxicity by Secondary Treatment,
W80-00678 5A

SWAMPS
Polychlorinated Biphenyls and Chlorinated Pesticides in Soils of the Everglades National Park and Adjacent Agricultural Areas,
W80-00618 5A

SWEDEN
Swedish Policy for Water Quality Protection,
W80-00454 6E

A History of Mercury Levels in Swedish Fauna,
W80-00649 5A

SWIMMING POOLS
Survey of Swimming Pool Algae of the Phoenix, Arizona, Metropolitan Area,
W80-00506 5C

SYSTEMS ANALYSIS
Environmental Aspects of Pollution Control in Hungary,
W80-00441 6A

SYSTEMS DEVELOPMENT
Polish Research Program for System-Oriented Regional Management of Water Resources,
W80-00444 6A

TAX INCENTIVES
Federal Tax Incentives for Private Environmental Planning,
W80-00496 6E

TCDD
The Response of Coho Salmon and Guppies to 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) in Water,
W80-00651 5A

TECHNICAL COOPERATION
Technical Cooperation Among Developing Countries with Regard to Water Resources Development.
W80-00425 6E

TECHNOLOGY
The Promise of Technology: Potential and Limitations, Part One,
W80-00402 6A

The Promise of Technology: Potential and Limitations. Part Two,
W80-00403 6A

World Bank: An Approach for Selection of Labour Vs. Capital Intensive Technologies for Water Resource Development Projects.
W80-00412 6C

Water for the Thousand Millions,
W80-00432 6A

Water Resources, Planning and Management: A Select Bibliography,
W80-00438 6A

On Role of Administrative, Economic and Technological Measures in Protection of Surface and Subterranean Water Against Contamination and Depletion,
W80-00465 6E

TERATOGENS
Effects of Oral Administration of Cadmium on Fish-V Effects on Calcium and Inorganic Phosphorus Excretion in the Carp,
W80-00663 5A

TERRACING
Conservation Bench Terraces for Rice in a Subhumid Climate,
W80-00595 3F

TESTING
A Model for Simulating Lake Ecosystems,
W80-00521 5C

TETHERED FLOAT BREAKWATERS
Performance Analysis of Tethered Float Breakwater,
W80-00587 8B

TETRALIN HYPEROXIDE
Photooxidation Products of a Fuel Oil and Their Antimicrobial Activity,
W80-00671 5B

TFM
Toxicity of Fishery Chemicals to the Asiatic Clam, Corbicula Manilensis,
W80-00785 5A

THAILAND
Water for Domestic Use in Rural Areas - Thailand,
W80-00448 6D

THEORETICAL ANALYSIS
Foundation Theories of Solute Transport in Porous Media: A Critical Review,
W80-00606 2A

THERMAL PLUMES
Source Schematization Effects on Farfield Results,
W80-00723 2H

THERMAL STRATIFICATION
Growth Rates and Temperature Selection of Bluegill, Lepomis Macrochirus,
W80-00654 5C

THERMOCLINE
On the Growth of Instabilities in Groundwater Due to Temperature and Salinity Gradients,
W80-00605 2F

THERMOHALINE CONVECTION
On the Growth of Instabilities in Groundwater Due to Temperature and Salinity Gradients,
W80-00605 2F

THOMPSON RIVER (BRITISH COLUMBIA)
Importance of Lake-River Interaction on Seasonal Patterns in the General Circulation of Kamloops Lake, British Columbia,
W80-00631 2H

TIDAL CURRENTS
An Assessment of the Effects of Bathymetric Changes Associated with Sand and Gravel Mining on Tidal Circulation in the Lower Bay of New York Harbor,
W80-00693 2J

The Lower Bay Complex,
W80-00695 2J

TIDES
Shelf Sea Fronts' Adjustments Revealed by Satellite IR Imagery,
W80-00603 2L

TIGRIS RIVER (IRAQ)
A Water Quality Study of a Stretch of the River Tigris,
W80-00623 5A

TILAPIA
Acclimation to Ammonia by Tilapia Aurea,
W80-00653 5A

Comparison of Anesthetic Potency of Benzocaine Hydrochloride and MS-222 in Two Freshwater Fish Species,
W80-00784 5A

TIME SERIES ANALYSIS
An Analysis of Residential Demand for Water Using Micro Time-Series Data,
W80-00599 6D

Time Series Analysis of Ammonia in the Passaic River,
W80-00638 5C

TISSUE ANALYSIS
A History of Mercury Levels in Swedish Fauna,
W80-00649 5A

Acclimation to Ammonia by Tilapia Aurea,
W80-00653 5A

Total and Methylmercury Levels in Three Species of Whelks,
W80-00656 5A

Trace Metals in Seaducks of the Fraser River Delta Intertidal Area, British Columbia,
W80-00657 5A

Uptake, Binding and Clearance of Divalent Cadmium in Glycera Dibranchiata (Annelida: Polychaeta),
W80-00664 5A

Body Burden of Chromium, Copper, Cadmium and Lead in the Neustonic Copepod Anomalocera Patersoni (Pontellidae) Collected from the Mediterranean Sea,
W80-00665 5A

Nephrocalcinosis in Rainbow Trout Salmo Gairdneri Richardson; The Effect of Exposure to Elevated CO2 Concentrations,
W80-00674 5A

Hepatomas in Atlantic Tomcod Microgadus Tomcod (Walbaum) Collected in the Hudson River Estuary in New York,
W80-00675 5B

The Role of Melano-Macrophage Centres in Iron Storage in Normal and Diseased Fish,
W80-00683 5A

Some Observations on Pollutants of Velsao Bay (GOA),
W80-00688 5A

Analysis of Toxicity Data for California Marine Water Quality Standards,
W80-00689 5C

Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

Uptake of Cadmium by the Eelgrass Zostera Marina,
W80-00789 5A

The Rock Oyster Saccostrea Glomerata as an Indicator of Trace Metals in Hong Kong,
W80-00793 5A

Chronic Toxicity of Vanadium to Flagfish,
W80-00795 5A

Toxic Effects of Aqueous Extracts of Ekofisk Crude Oil, Crude Oil Fractions, and Commercial Oil Products on the Development of Sea Urchin Eggs,
W80-00798 5A

Lead and Mercury in Lesser Snow Geese Wintering in Louisiana,
W80-00799 5A

TOXICITY
Sensitivity of Alaskan Freshwater and Anadromous Fishes to Prudhoe Bay Crude Oil and Benzene,
W80-00660 5A

Effects of Oral Administration of Cadmium on Fish-V Effects on Calcium and Inorganic Phosphorus Excretion in the Carp,
W80-00663 5A

Effects of Kuwait Oils on Feeding Rates of Copepods,
W80-00666 5A

Measurement of Complexing Materials Excreted from Algae and Their Ability to Ameliorate Copper Toxicity,
W80-00667 5A

Photooxidation Products of a Fuel Oil and Their Antimicrobial Activity,
W80-00671 5B

The Effect of Cadmium and Lead on the Growth of Two Species of Marine Phytoplankton with Particular Reference to the Development of Tolerance,
W80-00676 5A

Reduction of Nonionic Surfactant Toxicity by Secondary Treatment,
W80-00678 5A

Acute Toxicity of Copper, Cadmium and Zinc to Three Species of Marine Copepod,
W80-00679 5A

The Effect of Zinc on the Increase in Length of Five Species of Intertidal Fucales,
W80-00682 5B

A Morphometric Study of Lead and Copper Effects on Diatoma Tenue Var. Elongatum (Bacillariophyta),
W80-00782 5A

Interactive Effects of Salinity, Temperature and Polycyclic Aromatic Hydrocarbons on the Survival and Development Rate of Larvae of the Mud Crab Rhithropanopeus Harrisii,
W80-00790 5A

Effects of Artificial Eutrophication on the Metabolism of the Japanese Oyster Crassostrea Gigas,
W80-00792 5B

The Use of Chironomid Pupal Exuviae in the Surveillance of Sewage Pollution Within a Drainage System,
W80-00794 5A

Chronic Toxicity of Vanadium to Flagfish,
W80-00795 5A

Toxic Effects of Aqueous Extracts of Ekofisk Crude Oil, Crude Oil Fractions, and Commercial Oil Products on the Development of Sea Urchin Eggs,
W80-00798 5A

TOXINS
Toxicity and Pharmacology of Extracts from Dorid Nudibranchs,
W80-00673 5A

TRACE ELEMENTS
The Rock Oyster Saccostrea Glomerata as an Indicator of Trace Metals in Hong Kong,
W80-00793 5A

TRACERS
Isotope Hydrology.
W80-00421 4A

Estimating the Gas and Dye Quantities for Modified Tracer Technique Measurements of Stream Reaeration Coefficients,
W80-00773 5B

TRANSPORT EQUATIONS
Foundation Theories of Solute Transport in Porous Media: A Critical Review,
W80-00606 2A

TRANSPORTATION
U.S. Inland Water Transportation,
W80-00473 6E

TRAVEL TIME
Casing and Leak Depths, and Solute Travel Times to Wells,
W80-00579 5B

TREATIES
International River Basin Co-Operation: The Lessons from Experience,
W80-00430 6A

Experiences in Joint Administration of Border Watercourses,
W80-00452 6A

Boundary Waters Management,
W80-00480 6E

TREATMENT FACILITIES
Analysis of Operations and Maintenance Costs for Municipal Wastewater Treatment Systems,
W80-00549 6B

TREES
Extension of River Flow Records in Argentina from Long Tree-Ring Chronologies,
W80-00731 2E

Rainfall Interception by Eight Small Trees,
W80-00744 2I

Evaporation from Vegetation in Landscapes Developing Secondary Salinity Using the Ventilated-Chamber Technique, I. Comparative Transpiration from Juvenile Eucalyptus Above Saline Groundwater Seeps,
W80-00755 2I

TRIANGLE J REGION (NC)
Individual Non-Urban Wastewater Treatment and Management Alternatives: Task B: Summary of Alternative On-Site Wastewater Treatment and Disposal Methods, Region J, N.C.
W80-00534 5D

TRIBUTARIES
The Importance of Tributary Streams to the Reproduction of Catostomios and Sauger,
W80-00637 6G

Drainage Areas of the Twelvepole Creek Basin, West Virginia, Big Sandy River Basin, West Virginia, Tug Fork Basin, Virginia, Kentucky, West Virginia,
W80-00765 7C

TRIHALOMETHANES
A Comparison of Dynamic and Static Head Space and Solvent Extraction Techniques for the Determination of Trihalomethanes in Water,
W80-00617 5A

TROPICAL REGIONS
Sediment Yield and Land Use in Tropical Catchments,
W80-00746 2J

A Statistical Method for Modelling the Fate of Rainfall in a Tropical Rainforest Catchment,
W80-00748 2E

TROUT
Integration of Thermal and Food Processing Residuals into a System for Commercial Culture of Freshwater Shrimp. (Power Plant Waste Heat Utilization in Aquaculture)., Volume II,
W80-00497 3C

TUG FORK BASIN
Drainage Areas of the Twelvepole Creek Basin, West Virginia, Big Sandy River Basin, West Virginia, Tug Fork Basin, Virginia, Kentucky, West Virginia,
W80-00765 7C

TUNDRA
Phosphorus Cycling in Alaskan Coastal Tundra: A Hypothesis for the Regulation of Nutrient Cycling,
W80-00503 5C

TURBULENCE
Influence of Turbulence on the Accuracy of Discharge Measurements in Natural Streamflows,
W80-00745 2E

TURBULENT FLOW
Turbulent Flow in a Depth-Limited Boundary Layer,
W80-00741 8B

TWELVEPOLE CREEK BASIN
Drainage Areas of the Twelvepole Creek Basin, West Virginia, Big Sandy River Basin, West Virginia, Tug Fork Basin, Virginia, Kentucky, West Virginia,
W80-00765 7C

TWO-DIMENSIONAL FLOW
A Galerkin in Time, Linearized Finite Element Model of 2-Dimensional Unsaturated Porous Media Drainage,
W80-00753 2G

TYGART DAM (WV)
Special Flood Hazard Information Report: Tygart River, Taylor County, West Virginia,
W80-00538 2E

TYGART RIVER (WV)
Special Flood Hazard Information Report: Tygart River, Taylor County, West Virginia,
W80-00538 2E

UNCERTAINTIES
Screening Objectives and Uncertainties in Water Resources Planning,
W80-00551 6A

UNDERGROUND WASTE DISPOSAL
Recharge to Low-Level Radioactive-Waste Burial Trenches 11 Through 14, West Valley, New York,
W80-00775 5E

UNIT HYDROGRAPHS
Some Dimensional Considerations in the Unit Hydrograph Theory,
W80-00591 2E

UNITED KINGDOM
Policy and Organization of Water Research in the United Kingdom.
W80-00439 6A

River Basin Management in the United Kingdom.
W80-00449 6A

UNITED NATIONS
Note to the United Nations Water Conference on Preparations for the United Nations Conference on Desertification.
W80-00422 2A

UNITED NATIONS CHILDREN'S FUND
Drinking Water Supply - A Field for UNICEF Assistance.
W80-00420 5D

UNITED NATIONS WATER CONFERENCE
Present and Future Activities of the United Nations System in Water Resources Development.
W80-00405 6A

Report of the ESCAP Regional Preparatory Meeting for the United Nations Water Conference.
W80-00406 6A

Report of the Regional Preparatory Meeting of the Countries of Latin America and the Caribbean for the United Nations Water Conference,
W80-00407 6A

Economic Commission for Europe. Regional Report,
W80-00408 6A

Economic Commission for Africa, Regional Report,
W80-00409 6A

Report of the Economic Commission for Western Asia Regional Preparatory Meeting.
W80-00410 6A

The Water Resources of Latin America Regional Report,
W80-00415 6A

UNITED STATES
Toxic Substances in Water--The U.S. Experience.
W80-00456 5G

The United States Experience in Flood Plain Management,
W80-00459 6F

U.S. Inland Water Transportation,
W80-00473 6E

Current Methodologies for the Collection and Dissemination of Water Resources Data in the United States,
W80-00474 7A

Coastal Zone Management In The United States,
W80-00478 6E

Boundary Waters Management,
W80-00480 6E

Water USA: 1776-1976,
W80-00486 6E

Accuracy of Snow and Ice Monitoring,
W80-00575 2C

UPWELLING
On the Generation of the Seasonal Coastal Upwelling in the Gulf of Guinea,
W80-00608 2L

Upwelling and Estuary Flushing,
W80-00632 2L

URBAN HYDROLOGY
Socio-Economic Aspects of Urban Water Resources Planning and Management,
W80-00413 6A

Technique for Estimating the Magnitude and Frequency of Floods in St. Louis County, Missouri,
W80-00762 2E

URBAN RUNOFF
Petroleum Hydrocarbons in Urban Runoff,
W80-00730 5B

URBAN SOCIOLOGY
Socio-Economic Aspects of Urban Water Resources Planning and Management,
W80-00413 6A

URBANIZATION
Effects of Urbanization on the Magnitude and Frequency of Floods in Northeastern Illinois,
W80-00769 4C

Determination of Peak Discharge from Rainfall Data for Urbanized Basins, Wichita, Kansas,
W80-00774 6A

USSR
Snow and Ice Data Sets for Climate and Water Resource Studies with Particular Reference to North America,
W80-00567 2C

VACUUM DRYING
Best Ways to Dewater Dredged Material,
W80-00733 2G

VALUATION
An Analysis of Values for Development of Recreational Policy,
W80-00500 6A

VANADIUM
Chronic Toxicity of Vanadium to Flagfish,
W80-00795 5A

VENTILATION
A Wind Tunnel Investigation of the Rate of Evaporation of Large Water Drops Falling at Terminal Velocity in Air,
W80-00602 2B

VINELAND (NJ)
Long-Term Effects of Land Application of Domestic Wastewater: Vineland, New Jersey, Rapid Infiltration Site,
W80-00529 5E

VIRUS
Effectiveness of Sand Filters for Bacteriophage Escherichia Coli T1 Removal Using Calcium as an Aid,
W80-00493 5D

VIRUSES
Transport of Viruses Through Organic Soils and Sediments,
W80-00584 5E

VISCOSITY
Physical Components of the Diffusivity Coefficient,
W80-00754 2G

WASHINGTON
Instream Flow Strategies for Washington,
W80-00531 6E

Upwelling and Estuary Flushing,
W80-00632 2L

Comparison of Selected Cultural, Physical, and Water-Quality Characteristics of Lakes in Washington,
W80-00766 2H

WASTE DISPOSAL
Socio-Economic Aspects of Urban Water Resources Planning and Management,
W80-00413 6A

WASTE TREATMENT
Individual Non-Urban Wastewater Treatment and Management Alternatives: Task B: Summary of Alternative On-Site Wastewater Treatment and Disposal Methods, Region J, N.C.
W80-00534 5D

Mutagenic Activity in Organic Wastewater Concentrates,
W80-00670 5A

WASTE WATER DISPOSAL
Principles and Methods for the Provision of Economic Incentives in Water Supply and Waste Water Disposal Systems.
W80-00436 6B

Transport of Viruses Through Organic Soils and Sediments,
W80-00584 5E

Large Array of Wastewater Reuse Options for Pima County, Arizona,
W80-00646 6B

WASTE WATER (POLLUTION)
Evaluation of a Digital Model for Estuarine Water Quality Simulation in Waste Allocation Studies,
W80-00761 5B

WASTE WATER TREATMENT
The Promise of Technology: Potential and Limitations. Part Two,
W80-00403 6A

Main Trends in Treatment of Municipal and Industrial Sewage in the USSR,
W80-00464 5D

Environmental Pollution Control Alternatives: Municipal Wastewater,
W80-00544 5D

Large Array of Wastewater Reuse Options for Pima County, Arizona,
W80-00646 6B

WASTEWATER DISPOSAL
Individual Non-Urban Wastewater Treatment and Management Alternatives: Task B: Summary of Alternative On-Site Wastewater Treatment and Disposal Methods, Region J, N.C.
W80-00534 5D

WASTEWATER MANAGEMENT
Integration of Residual Waste Management with Water Quality Management,
W80-00526 6E

WASTEWATER QUALITY
The Use of the ATP Assay for Rapid Assessment of Water Quality,
W80-00552 5A

WASTEWATER TREATMENT
On Water Reuse Promotion Measures,
W80-00477 6F

Individual Non-Urban Wastewater Treatment and Management Alternatives: Task B: Summary of Alternative On-Site Wastewater Treatment and Disposal Methods, Region J, N.C.
W80-00534 5D

Analysis of Operations and Maintenance Costs for Municipal Wastewater Treatment Systems,
W80-00549 6B

WATER ALLOCATION
Appropriative Water Rights and Efficient Allocation of Resources,
W80-00548 6E

WATER ALLOCATION (POLICY)
Development of Water Resources and its Influence on the Ecology of Saudi Arabia,
W80-00640 6G

Water Use Information for Pima County, Arizona,
W80-00645 7B

WATER BALANCE
Restriction of Supply and Risk in Water Supply Systems,
W80-00442 6C

World Water Balance and Water Resources of the Earth,
W80-00466 2A

WATER CHEMISTRY
A Comparison of Dynamic and Static Head Space and Solvent Extraction Techniques for the Determination of Trihalomethanes in Water,
W80-00617 5A

Chemical Aspects of a Brine Pool at the East Flower Garden Bank, Northwestern Gulf of Mexico,
W80-00626 2K

A Survey of the Biota, Environment and Use for Recreation of Twelve Lakes in Snowdonia,
W80-00699 5C

WATER CIRCULATION
Importance of Lake-River Interaction on Seasonal Patterns in the General Circulation of Kamloops Lake, British Columbia,
W80-00631 2H

Upwelling and Estuary Flushing,
W80-00632 2L

Energy Exchange Between Deep Lakes and the Atmosphere and the Consequences for the Wind-Mixed Layer Dynamics,
W80-00713 2L

WATER CONSERVATION
World Bank: Pricing as a Means of Controlling the Use of Water Resources.
W80-00411 6C

The Projects for the Increase of the Nile Yield with Special Reference to Jonglei Project,
W80-00447 4A

Water Resources Development, and Management Planning in Arid Zones: Case History-Israel,
W80-00457 6A

Israel- A Model of Efficient Utilization of a Country's Water Resources,
W80-00471 6E

Large Array of Water Conservation Strategies for Pima County, Arizona,
W80-00648 3D

WATER DEMAND
Resources and Needs: Assessment of the World Water Situation,
W80-00401 6A

The Promise of Technology: Potential and Limitations, Part One,
W80-00402 6A

World Bank: Pricing as a Means of Controlling the Use of Water Resources.
W80-00411 6C

The Water Resources of Latin America Regional Report,
W80-00415 6A

Restriction of Supply and Risk in Water Supply Systems,
W80-00442 6C

River Basin Management in the United Kingdom.
W80-00449 6A

Water Usage Profile-Fort Carson Co.,
W80-00494 6D

Urban Residential Demand for Water in the United States,
W80-00495 6D

Long-Term Availability of Water Resources for Energy Development in the Central United States,
W80-00499 6D

Water Supply for Urban Areas: Problems in Meeting Future Demand,
W80-00543 6D

An Analysis of Residential Demand for Water Using Micro Time-Series Data,
W80-00599 6D

WATER DISTRIBUTION

Irrigation Management in Developing Countries: A Suggested Action Programme,
W80-00481 3F

WATER HYACINTH

Efficacy, Uptake and Distribution of Different Herbicides in the Water Hyacinth,
W80-00519 5C

WATER LAW

Water Law and Legislation: How to use them to Obtain Optimum Results from Water Resources,
W80-00428 6E

Water Resources, Planning and Management: A Select Bibliography,
W80-00438 6A

Water Law and Its Application in Poland,
W80-00443 6E

Instream Flow Strategies for Washington,
W80-00531 6E

Instream Flow Strategies for California,
W80-00532 6E

Ways to Resolve Critical Water Resources Issues Facing the Nation,
W80-00546 6E

WATER LEVELS

The Application of a Digital Model for Evaluating the Bedrock Water Resources of the Maumee River Basin, Northwestern Ohio,
W80-00726 2F

Evaporation from Vegetation in Landscapes Developing Secondary Salinity Using the Ventilated-Chamber Technique, I. Comparative Transpiration from Juvenile Eucalyptus Above Saline Groundwater Seeps,
W80-00755 2I

WATER LOSS

Influence of Surface Roughness and Clod Size and Stability on Soil and Water Losses,
W80-00593 2J

WATER MANAGEMENT

Hydrological Forecasting for Operational Planning and Management of Water Resources,
W80-00467 2E

Water Resources and the Nation's Water Supply: Issues and Concerns,
W80-00542 6B

WATER MANAGEMENT (ADMINISTRATIVE)

Integration of Residual Waste Management with Water Quality Management,
W80-00526 6E

WATER MANAGEMENT (APPLIED)

Resources and Needs: Assessment of the World Water Situation,
W80-00401 6A

The Promise of Technology: Potential and Limitations, Part One,
W80-00402 6A

The Promise of Technology: Potential and Limitations. Part Two,
W80-00403 6A

Policy Options,
W80-00404 6A

Present and Future Activities of the United Nations System in Water Resources Development.
W80-00405 6A

Economic Commission for Europe. Regional Report,
W80-00408 6A

Socio-Economic Aspects of Urban Water Resources Planning and Management,
W80-00413 6A

The Design and Evaluation of Institutional Arrangements for Water Planning and Management,
W80-00431 6E

Long-Term Planning of Water Management,
W80-00434 6A

CMEA Glossary on Water Management,
W80-00437 6A

Policy and Organization of Water Research in the United Kingdom.
W80-00439 6A

Water Law and Its Application in Poland,
W80-00443 6E

Polish Research Program for System-Oriented Regional Management of Water Resources,
W80-00444 6A

Computerized Optimization of Water Releases from Reservoirs,
W80-00445 4A

River Basin Management in the United Kingdom.
W80-00449 6A

The Long-Term National Programme for River Basin Development, Basis of the Water Management Policy in Romania,
W80-00450 6A

Finnish Experiences in Water-Resources Planning and Management Policy,
W80-00451 6A

Experiences in Joint Administration of Border Watercourses,
W80-00452 6A

The World's Water in a Human Perspective.
W80-00453 6A

Water, Food, and Fiber,
W80-00455 3F

Establishment of Quality Criteria for Water Use in Australia,
W80-00460 6E

Examples of the Organization of Self-Administration in the Water Economy of the Federal Republic of Germany,
W80-00470 6E

Israel- A Model of Efficient Utilization of a Country's Water Resources,
W80-00471 6E

River Basin Planning in Canada,
W80-00472 6A

U.S. Inland Water Transportation,
W80-00473 6E

Remote Sensing for Water Resources Management.
W80-00475 7B

Coastal Zone Management In The United States,
W80-00478 6E

Boundary Waters Management,
W80-00480 6E

Irrigation Management in Developing Countries: A Suggested Action Programme,
W80-00481 3F

Water USA: 1776-1976,
W80-00486 6E

Optimal Management of a Multireservoir Water Supply System,
W80-00583 4A

Irrigation Technology for Desert Land Reclamation,
W80-00641 3F

Large Array of Water Conservation Strategies for Pima County, Arizona,
W80-00648 3D

WATER POLICY

Policy Options,
W80-00404 6A

Water Law and Legislation: How to use them to Obtain Optimum Results from Water Resources,
W80-00428 6E

Principles and Methods for the Provision of Economic Incentives in Water Supply and Waste Water Disposal Systems.
W80-00436 6B

Policy and Organization of Water Research in the United Kingdom.
W80-00439 6A

Finnish Experiences in Water-Resources Planning and Management Policy,
W80-00451 6A

Swedish Policy for Water Quality Protection,
W80-00454 6E

Colorado River Basin Water Problems: How to Reduce Their Impact,
W80-00545 6E

Ways to Resolve Critical Water Resources Issues Facing the Nation,
W80-00546 6E

WATER POLLUTION

Integration of Residual Waste Management with Water Quality Management,
W80-00526 6E

Casing and Leak Depths, and Solute Travel Times to Wells,
W80-00579 5B

A Water Quality Study of a Stretch of the River Tigris,
W80-00623 5A

An Effort for Modelling the Transport of Micropollutants in Rivers,
W80-00702 5B

The Biocenotic Model,
W80-00707 5B

Computation of the Advancement of Groundwater Pollution Due to Petroleum Products Originating from a Known Source of Contamination (Le Calcul de la Propagation de la Pollution des Eaux Souterraines par des Materiaux Huileux, Provenants D'une Source de la Pollution Connue),
W80-00720 5B

Petroleum Hydrocarbons in Urban Runoff,
W80-00730 5B

WATER POLLUTION CONTROL

Eutrophication and Rehabilitation of Surface Waters,
W80-00417 5C

CMEA Glossary on Water Management,
W80-00437 6A

Environmental Aspects of Pollution Control in Hungary,
W80-00441 6A

Swedish Policy for Water Quality Protection,
W80-00454 6E

Toxic Substances in Water--The U.S. Experience.
W80-00456 5G

Establishment of Quality Criteria for Water Use in Australia,
W80-00460 6E

Methods of Ground-Water Protection from Pollution,
W80-00463 4B

On Role of Administrative, Economic and Technological Measures in Protection of Surface and Subterranean Water Against Contamination and Depletion,
W80-00465 6E

Pollution Control in the Mining Industry in South Africa,
W80-00484 5G

Implementation Strategies for Public Law 92-500, Section 208,
W80-00524 6E

Integrated Planning and Water Quality Management: The Federal Water Pollution Control Act Amendments of 1972 and Coastal Zone Management,
W80-00527 6E

WATER POLLUTION EFFECTS

Environmental Assessment of an Active Oil Field in the Northwestern Gulf of Mexico 1977-1978. Volume III: Chemical and Physical Investigations.
W80-00692 5C

Chemical Pollutants of the New York Bight; Priorities for Research,
W80-00697 5C

WATER POLLUTION SOURCES

Toxic Substances in Water--The U.S. Experience.
W80-00456 5G

Deterioration of Water Quality Due to Long Range Transport of Air Pollution,
W80-00458 5G

Pollution Control in the Mining Industry in South Africa,
W80-00484 5G

The Lower Bay Complex,
W80-00695 2J

WATER PROJECTS

Planning Status Report, Water Resources Appraisals for Hydroelectric Licensing: Lower Arkansas River Basin-Arkansas, Colorado, Kansas, New Mexico, Oklahoma and Texas,
W80-00533 6D

WATER PROPERTIES

Nature and Properties of Water in Montmorillonite-Water Systems,
W80-00597 2G

WATER QUALITY

Impacts of a Large Recreational Development on Water Quality in a Semi-Primitive Environment,
W80-00498 5C

Integration of Residual Waste Management with Water Quality Management,
W80-00526 6E

Integrated Planning and Water Quality Management: The Federal Water Pollution Control Act Amendments of 1972 and Coastal Zone Management,
W80-00527 6E

The Use of the ATP Assay for Rapid Assessment of Water Quality,
W80-00552 5A

Water Quality Investigation of Estuaries of Georgia, 1976,
W80-00553 2L

Water Quality in Channel Catfish Production Ponds,
W80-00619 5A

A Water Quality Study of a Stretch of the River Tigris,
W80-00623 5A

Chemical Pollutants of the New York Bight; Priorities for Research,
W80-00697 5C

On the Theoretical Basis of Modelling the Quality of Surface and Subsurface Waters,
W80-00700 5B

A Dynamic Model of the Chemical Nutrient System for Research of the Ecological Consequences in Natural Water,
W80-00701 5B

Hydrological and Geochemical Mass Balance in Small Forested and Agricultural Basins,
W80-00703 2A

Effects of the Construction of a Broad Waterway on the Water Quality of the Doubs (Effets de la Canalisation a Grand Gabarit sur la Qualite des Eaux du Doubs),
W80-00704 5B

Mass Transfer Models of Sorption and Desorption of Radionuclides by Aquatic Plants,
W80-00705 2A

On the Choice of Boundary Conditions for One-Dimensional Models of Estuarine Water Quality,
W80-00706 2L

The Biocenotic Model,
W80-00707 5B

The Use and Limitations of a Two-Dimensional Mixing Model for Rivers,
W80-00708 5B

Use of Water Quality Variables for Estimation of Water Quantity Characteristics,
W80-00709 2A

Adaptation of the EPAECO Model to a Lake in Central Finland,
W80-00710 2L

A Mathematical Ecosystem Model Applicable to Shallow Water Bodies,
W80-00711 2L

A Simple Eutrophication Model for the Bay of Keszthely, Lake Balaton,
W80-00712 2L

Nutrient Exchange Between Volume Elements of Large Lakes,
W80-00716 2H

Water Quality in Lentic Water Bodies (Lakes and Reservoirs),
W80-00717 2H

Natural Control of the Chemical Composition of Water During the Infiltration Process--First Results (Acquisition de la Composition Chimique de L'Eau au Cours de L'Infiltration en Milieu Naturel--Premiers Resultats D'Une Etude Experimentale),
W80-00719 5B

Simulation Model of the Evolution of the Chemical Composition of a Mineral-Solution System and its Applications (Modele de Simulation de L'Evolution de la Composition Chimique d'un Systeme Mineraux-Solution et ses Applications),
W80-00721 5A

Contamination Potential in the Silurian Dolomite Aquifer, Eastern Wisconsin,
W80-00757 5B

Ground-Water Appraisal for the Community of Kiryas Joel, Orange County, New York,
W80-00759 2A

Ground-Water Conditions and Potential for Artificial Recharge in Lucerne Valley, San Bernardino County, California,
W80-00763 4B

Annual Water-Resources Review, White Sands Missile Range, New Mexico, 1978,
W80-00764 4D

Water-Quality Assessment of Runoff from a Rural Highway Bridge Near Tallahassee, Florida,
W80-00767 5B

A Preliminary Appraisal of the Impact of Agriculture on Ground-Water Availability in Southwest Georgia,
W80-00770 4B

Stormwater-Runoff Data for a Commercial Area, Broward County, Florida,
W80-00772 4C

Water Resources Data for Wisconsin, Water Year 1978.
W80-00777 7C

Water Resources Data for South Carolina, Water Year 1978.
W80-00778 7C

Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 1. Hawaii.
W80-00779 7C

Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 2. Trust Territory of the Pacific Islands, Guam,

American Samoa, and Northern Mariana Islands,
W80-00780 7C

Survey of the Pollution in a Coastal Area of the Tyrrhenian Sea. Aerial Photography, Physico-Chemical and Microbiological Investigations and Mutagenic Monitoring,
W80-00796 5A

WATER QUALITY CONTROL
Implementation Strategies for Public Law 92-500, Section 208,
W80-00524 6E

WATER QUALITY CRITERIA
Establishment of Quality Criteria for Water Use in Australia,
W80-00460 6E

WATER QUALITY MANAGEMENT
Integration of Residual Waste Management with Water Quality Management,
W80-00526 6E

WATER QUALITY MANAGEMENT (APPLIED)
Implementation Strategies for Public Law 92-500, Section 208,
W80-00524 6E

Urban Stormwater Pollution: An Investigation of the Problem and Its Control,
W80-00525 5B

Integrated Planning and Water Quality Management: The Federal Water Pollution Control Act Amendments of 1972 and Coastal Zone Management,
W80-00527 6E

Individual Non-Urban Wastewater Treatment and Management Alternatives: Task B: Summary of Alternative On-Site Wastewater Treatment and Disposal Methods, Region J, N.C.
W80-00534 5D

WATER QUALITY STANDARDS
Microbiological Water Quality in Relation to Public Health,
W80-00482 3C

Analysis of Toxicity Data for California Marine Water Quality Standards,
W80-00689 5C

WATER QUANTITY
Water Supply for Urban Areas: Problems in Meeting Future Demand,
W80-00543 6D

WATER QUANTITY MANAGEMENT
Urban Stormwater Pollution: An Investigation of the Problem and Its Control,
W80-00525 5B

WATER RESOURCE DEVELOPMENT
Planning Status Report, Water Resources Appraisals for Hydroelectric Licensing: Lower Arkansas River Basin-Arkansas, Colorado, Kansas, New Mexico, Oklahoma and Texas,
W80-00533 6D

WATER RESOURCE PLANNING
Planning Status Report, Water Resources Appraisals for Hydroelectric Licensing: Lower Arkansas River Basin-Arkansas, Colorado, Kansas, New Mexico, Oklahoma and Texas,
W80-00533 6D

WATER RESOURCES
Assessment of Water Resources: Networks, Surveys, Services, and Related Facilities: Present Status and Requirements by 2000.
W80-00426 6A

Water Law and Legislation: How to use them to Obtain Optimum Results from Water Resources,
W80-00428 6E

On Role of Administrative, Economic and Technological Measures in Protection of Surface and Subterranean Water Against Contamination and Depletion,
W80-00465 6E

World Water Balance and Water Resources of the Earth,
W80-00466 2A

Current Methodologies for the Collection and Dissemination of Water Resources Data in the United States,
W80-00474 7A

Remote Sensing for Water Resources Management.
W80-00475 7B

Instream Flow Strategies for Washington,
W80-00531 6E

Instream Flow Strategies for California,
W80-00532 6E

Water Resources and the Nation's Water Supply: Issues and Concerns,
W80-00542 6B

Water Supply for Urban Areas: Problems in Meeting Future Demand,
W80-00543 6D

Colorado River Basin Water Problems: How to Reduce Their Impact,
W80-00545 6E

Impact Assessment of Water Resource Development Activities: A Dual Matrix Approach,
W80-00550 6B

Screening Objectives and Uncertainties in Water Resources Planning,
W80-00551 6A

Planning Theory: Multiobjectives,
W80-00556 6A

Planning Theory: The Role of Mathematical Models in Water Resources Planning,
W80-00557 6A

The Mathematical Programming Screening Model,
W80-00559 6A

The Mathematical Programming Sequencing Model,
W80-00562 6A

Water-Resources Investigations in Nevada, 1978.
W80-00776 7A

WATER RESOURCES DEVELOPMENT
Resources and Needs: Assessment of the World Water Situation,
W80-00401 6A

The Promise of Technology: Potential and Limitations. Part Two,
W80-00403 6A

Policy Options,
W80-00404 6A

Present and Future Activities of the United Nations System in Water Resources Development.
W80-00405 6A

Report of the Regional Preparatory Meeting of the Countries of Latin America and the Caribbean for the United Nations Water Conference,
W80-00407 6A

Economic Commission for Europe. Regional Report,
W80-00408 6A

Economic Commission for Africa, Regional Report,
W80-00409 6A

Report of the Economic Commission for Western Asia Regional Preparatory Meeting.
W80-00410 6A

World Bank: An Approach for Selection of Labour Vs. Capital Intensive Technologies for Water Resource Development Projects.
W80-00412 6C

Socio-Economic Aspects of Urban Water Resources Planning and Management,
W80-00413 6A

The Water Resources of Latin America Regional Report,
W80-00415 6A

Water, Women, and Development,
W80-00416 6A

Basic Needs Strategy and Water Resources Policy,
W80-00418 6A

World Employment Programme: Appropriate Construction Technology for Water Control and Irrigation Works in Developing Countries,
W80-00419 6A

Drinking Water Supply - A Field for UNICEF Assistance.
W80-00420 5D

Work of the International Law Commission on the Law of the Non-Navigational Uses of International Watercourses.
W80-00423 6E

Water for Agriculture.
W80-00424 4A

Technical Cooperation Among Developing Countries with Regard to Water Resources Development.
W80-00425 6E

Report on Community Water Supplies,
W80-00427 5F

Non Conventional Water Resources: Some Advances in their Development,
W80-00429 3C

Polish Research Program for System-Oriented Regional Management of Water Resources,
W80-00444 6A

The Projects for the Increase of the Nile Yield with Special Reference to Jonglei Project,
W80-00447 4A

Finnish Experiences in Water-Resources Planning and Management Policy,
W80-00451 6A

The World's Water in a Human Perspective.
W80-00453 6A

Water, Food, and Fiber,
W80-00455 3F

Water Resources Development, and Management Planning in Arid Zones: Case History-Israel,
W80-00457 6A

Israel- A Model of Efficient Utilization of a Country's Water Resources,
W80-00471 6E

River Basin Planning in Canada,
W80-00472 6A

Water USA: 1776-1976,
W80-00486 6E

Floral and Faunal Changes in Lowland Hardwood Forests in Missouri Resulting from Channelization, Drainage, and Impoundment,
W80-00528 6G

Ways to Resolve Critical Water Resources Issues Facing the Nation,
W80-00546 6E

Appropriative Water Rights and Efficient Allocation of Resources,
W80-00548 6E

Impact Assessment of Water Resource Development Activities: A Dual Matrix Approach,
W80-00550 6B

Applied Water Resource Systems Planning,
W80-00554 6A

The Rio Colorado Basin,
W80-00555 6A

Simulation Analyses: The Detailed Model,
W80-00561 2A

Engineering and Cost Parameters,
W80-00564 6B

Development of Water Resources and its Influence on the Ecology of Saudi Arabia,
W80-00640 6G

Water Resources and Land Reclamation in Egypt,
W80-00643 6B

A Comparative Analysis of Multi-Source Water Supply Data for Pima County, Arizona,
W80-00644 6D

WATER RESOURCES MANAGEMENT

Water Resources, Planning and Management: A Select Bibliography,
W80-00438 6A

Water Supply for Urban Areas: Problems in Meeting Future Demand,
W80-00543 6D

Colorado River Basin Water Problems: How to Reduce Their Impact,
W80-00545 6E

WATER RESOURCES PLANNING

Implementation Strategies for Public Law 92-500, Section 208,
W80-00524 6E

Colorado River Basin Water Problems: How to Reduce Their Impact,
W80-00545 6E

Ways to Resolve Critical Water Resources Issues Facing the Nation,
W80-00546 6E

WATER REUSE

Non Conventional Water Resources: Some Advances in their Development,
W80-00429 3C

On Water Reuse Promotion Measures,
W80-00477 6F

Microbiological Water Quality in Relation to Public Health,
W80-00482 3C

Chemical Seepage from a Tail Water Recovery Pit to Adjacent Ground Water,
W80-00621 5B

Wastewater as a Source of Nutrients and Water for Hydroponic Crop Production in Arid Regions,
W80-00642 5F

Large Array of Wastewater Reuse Options for Pima County, Arizona,
W80-00646 6B

WATER RIGHTS

Water Law and Its Application in Poland,
W80-00443 6E

Inter-State Rivers in Australia,
W80-00461 6E

Appropriative Water Rights and Efficient Allocation of Resources,
W80-00548 6E

WATER SHORTAGE

The World's Water in a Human Perspective.
W80-00453 6A

Development of Water Resources and its Influence on the Ecology of Saudi Arabia,
W80-00640 6G

WATER SOURCES

Finnish Experiences in Water-Resources Planning and Management Policy,
W80-00451 6A

WATER SPORTS

Socio-Economic Relationships for Water-Based Recreation Involvement in Indiana,
W80-00636 6B

WATER STORAGE

The Environmental Impacts of the Aswan High Dam,
W80-00446 5C

WATER SUPPLY

Resources and Needs: Assessment of the World Water Situation,
W80-00401 6A

The Promise of Technology: Potential and Limitations, Part One,
W80-00402 6A

The Promise of Technology: Potential and Limitations. Part Two,
W80-00403 6A

Report of the ESCAP Regional Preparatory Meeting for the United Nations Water Conference.
W80-00406 6A

Economic Commission for Africa, Regional Report,
W80-00409 6A

World Bank: Pricing as a Means of Controlling the Use of Water Resources.
W80-00411 6C

Socio-Economic Aspects of Urban Water Resources Planning and Management,
W80-00413 6A

The Water Resources of Latin America Regional Report,
W80-00415 6A

Drinking Water Supply - A Field for UNICEF Assistance.
W80-00420 5D

Water Law and Legislation: How to use them to Obtain Optimum Results from Water Resources,
W80-00428 6E

Principles and Methods for the Provision of Economic Incentives in Water Supply and Waste Water Disposal Systems.
W80-00436 6B

Water Resources, Planning and Management: A Select Bibliography,
W80-00438 6A

Restriction of Supply and Risk in Water Supply Systems,
W80-00442 6C

The Response of Groundwater Systems to Drought,
W80-00462 4B

Examples of the Organization of Self-Administration in the Water Economy of the Federal Republic of Germany,
W80-00470 6E

Water Resources and the Nation's Water Supply: Issues and Concerns,
W80-00542 6B

Water Supply for Urban Areas: Problems in Meeting Future Demand,
W80-00543 6D

Colorado River Basin Water Problems: How to Reduce Their Impact,
W80-00545 6E

Optimal Management of a Multireservoir Water Supply System,
W80-00583 4A

Water Resources and Land Reclamation in Egypt,
W80-00643 6B

A Comparative Analysis of Multi-Source Water Supply Data for Pima County, Arizona,
W80-00644 6D

Water Use Information for Pima County, Arizona,
W80-00645 7B

Projected Water Use and Water Budget Calculations for Pima County, Arizona,
W80-00647 6B

WATER SUPPLY DEVELOPMENT

Water for Agriculture.
W80-00424 4A

Report on Community Water Supplies,
W80-00427 5F

Non Conventional Water Resources: Some Advances in their Development,
W80-00429 3C

Water for the Thousand Millions,
W80-00432 6A

Environmental Issues in River Basin Development,
W80-00433 2A

Water for Domestic Use in Rural Areas - Thailand,
W80-00448 6D

River Basin Management in the United Kingdom.
W80-00449 6A

The Long-Term National Programme for River Basin Development, Basis of the Water Management Policy in Romania,
W80-00450 6A

Finnish Experiences in Water-Resources Planning and Management Policy,
W80-00451 6A

The World's Water in a Human Perspective.
W80-00453 6A

Water Resources Development, and Management Planning in Arid Zones: Case History-Israel,
W80-00457 6A

The Main Directions of Hydrogeological Investigations for the Substantiation of Artificial Recharge,
W80-00468 2A

Israel- A Model of Efficient Utilization of a Country's Water Resources,
W80-00471 6E

The Industrial Water Service of Japan,
W80-00476 6E

Increasing Available Water Supplies Through Weather Modification and Desalination,
W80-00479 2B

Inter Basin Water Transfers in South Africa,
W80-00483 6D

Water Resources and the Nation's Water Supply: Issues and Concerns,
W80-00542 6B

A Comparative Analysis of Multi-Source Water Supply Data for Pima County, Arizona,
W80-00644 6D

WATER TEMPERATURE

Thermal Shock Resistance of Spot (Leiostomus Xanthurus) After Acclimation to Constant or Cycling Temperature,
W80-00652 5C

Source Schematization Effects on Farfield Results,
W80-00723 2H

Temperature-Monitoring and Safety-Control Device,
W80-00783 5A

The Temperature Preference of the Three-Spined Stickleback, Gasterosteus Aculeatus L. (Pisces), Collected at Different Seasons,
W80-00797 5A

WATER TRANSFER

Inter Basin Water Transfers in South Africa,
W80-00483 6D

WATER USE

Water Supply for Urban Areas: Problems in Meeting Future Demand,
W80-00543 6D

WATER USERS

Urban Residential Demand for Water in the United States,
W80-00495 6D

WATER UTILIZATION

World Bank: Pricing as a Means of Controlling the Use of Water Resources.
W80-00411 6C

Water Law and Its Application in Poland,
W80-00443 6E

Long-Term Availability of Water Resources for Energy Development in the Central United States,
W80-00499 6D

Colorado River Basin Water Problems: How to Reduce Their Impact,
W80-00545 6E

A Comparative Analysis of Multi-Source Water Supply Data for Pima County, Arizona,
W80-00644 6D

Water Use Information for Pima County, Arizona,
W80-00645 7B

Projected Water Use and Water Budget Calculations for Pima County, Arizona,
W80-00647 6B

Water Withdrawals in Illinois, 1978,
W80-00722 7C

WATER VAPOR

Precipitable Water Over the United States. Volume II: Semimonthly Maxima,
W80-00698 2B

WATER WELLS

Annual Water-Resources Review, White Sands Missile Range, New Mexico, 1978,
W80-00764 4D

WATER YIELD

A Comparative Analysis of Multi-Source Water Supply Data for Pima County, Arizona,
W80-00644 6D

Annual Water-Resources Review, White Sands Missile Range, New Mexico, 1978,
W80-00764 4D

WATER YIELD IMPROVEMENT

Large Array of Water Conservation Strategies for Pima County, Arizona,
W80-00648 3D

WATERSHEDS (BASINS)

Landsat-Derived Snow Cover as a Forecast Tool in the Rio Grande Basin in Colorado,
W80-00573 2C

Hydrological and Geochemical Mass Balance in Small Forested and Agricultural Basins,
W80-00703 2A

Streamflow Generation in a Forested Watershed, New Zealand,
W80-00724 2E

An Application Runoff Model Strategy for Ungaged Watersheds,
W80-00728 2E

Sediment Yield and Land Use in Tropical Catchments,
W80-00746 2J

A Statistical Method for Modelling the Fate of Rainfall in a Tropical Rainforest Catchment,
W80-00748 2E

A Finite-Element Distributed Catchment Model, II. Application to Real Catchments,
W80-00749 2E

WATERSHEDS (DIVIDES)

Drainage Areas of the Twelvepole Creek Basin, West Virginia, Big Sandy River Basin, West Virginia, Tug Fork Basin, Virginia, Kentucky, West Virginia,
W80-00765 7C

WAVE THEORY

Tillamook Bay Entrance Refraction Study, Tillamook, Oregon,
W80-00501 8A

WAVES (WATER)

Tillamook Bay Entrance Refraction Study, Tillamook, Oregon,
W80-00501 8A

Performance Analysis of Tethered Float Breakwater,
W80-00587 8B

Energetics of Breaking Waves Within the Surf Zone,
W80-00737 2L

WEATHER MODIFICATION

Increasing Available Water Supplies Through Weather Modification and Desalination,
W80-00479 2B

WELL CASINGS

Casing and Leak Depths, and Solute Travel Times to Wells,
W80-00579 5B

WELLS

Methods of Ground-Water Protection from Pollution,
W80-00463 4B

Casing and Leak Depths, and Solute Travel Times to Wells,
W80-00579 5B

WEST VALLEY (NY)

Recharge to Low-Level Radioactive-Waste Burial Trenches 11 Through 14, West Valley, New York,
W80-00775 5E

WEST VIRGINIA

Special Flood Hazard Information Report: Tygart River, Taylor County, West Virginia,
W80-00538 2E

WETLANDS

Guidelines for Urban Development in Louisiana's Coastal Wetlands,
W80-00547 4C

Environmental Observations of a Riparian Ecosystem During Flood Season,
W80-00691 2E

WETTING POTENTIAL

Predicting Hysteretic Effects in Evaporation From Bare Soil,
W80-00732 2D

WHITE SANDS MISSILE RANGE (NM)

Annual Water-Resources Review, White Sands Missile Range, New Mexico, 1978,
W80-00764 4D

WICHITA (KANS)

Determination of Peak Discharge from Rainfall Data for Urbanized Basins, Wichita, Kansas,
W80-00774 6A

WILDLIFE CONSERVATION

Summary: Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00633 6G

Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00634 6G

WILDLIFE HABITAT

Floral and Faunal Changes in Lowland Hardwood Forests in Missouri Resulting from Channelization, Drainage, and Impoundment,
W80-00528 6G

WINTERKILLING

Oxygen Depletion and Winterkill Risk in Small Prairie Lakes Under Extended Ice Cover,
W80-00668 5A

WISCONSIN

Water Resources Data for Wisconsin, Water Year 1978.
W80-00777 7C

WITHDRAWAL

The Application of a Digital Model for Evaluating the Bedrock Water Resources of the Maumee River Basin, Northwestern Ohio,
W80-00726 2F

WOMEN

Water, Women, and Development,
W80-00416 6A

WORLD
World Water Balance and Water Resources of the Earth,
W80-00466 2A

WORLD FOOD CONFERENCE
Water for Agriculture.
W80-00424 4A

WORMS
Degradation of Selected Polycyclic Aromatic Hydrocarbons in Coastal Sediments: Importance of Microbes and Polychaete Worms,
W80-00613 5A

WYOMING COUNTY (NY)
Ground Water in Dale Valley, New York,
W80-00768 4B

ZINC
Zinc Uptake in Marine Diatoms,
W80-00669 5A

Acute Toxicity of Copper, Cadmium and Zinc to Three Species of Marine Copepod,
W80-00679 5A

The Effect of Zinc on the Increase in Length of Five Species of Intertidal Fucales,
W80-00682 5B

Some Observations on Pollutants of Velsao Bay (GOA),
W80-00688 5A

Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

The Rock Oyster Saccostrea Glomerata as an Indicator of Trace Metals in Hong Kong,
W80-00793 5A

ZOOPLANKTON
Phytoplankton Succession in Nutrient Enriched Experimental Ponds As Related to Changing Carbon, Nitrogen, and Phosphorus Conditions,
W80-00517 5C

ZOSTERA
Uptake of Cadmium by the Eelgrass Zostera Marina,
W80-00789 5A

AUTHOR INDEX

ADAMSON, R. P.
Survey of Swimming Pool Algae of the Phoenix, Arizona, Metropolitan Area,
W80-00506 5C

AGIUS, C.
The Role of Melano-Macrophage Centres in Iron Storage in Normal and Diseased Fish,
W80-00683 5A

AHMAD, S.
A Water Quality Study of a Stretch of the River Tigris,
W80-00623 5A

AHSANULLAH, M.
Acute Toxicity of Copper, Cadmium and Zinc to Three Species of Marine Copepod,
W80-00679 5A

ALABASTER, J. S.
The Survival of Smolts of Salmon Salmo Salar L. at Low Concentrations of Dissolved Oxygen,
W80-00655 5A

ALASAARELA, E.
Phytoplankton in the Coastal Waters of the Bothnian Bay Off Kemi,
W80-00518 5C

ALEXANDER, T. W.
Technique for Estimating the Magnitude and Frequency of Floods in St. Louis County, Missouri,
W80-00762 2E

ALFOLDI, L.
Methods for Estimating Ground Water Resources and the Balance of Subsurface Waters,
W80-00440 6B

ALLAYAUD, W. K.
Integrated Planning and Water Quality Management: The Federal Water Pollution Control Act Amendments of 1972 and Coastal Zone Management,
W80-00527 6E

ALLEN, H. E. JR.
Effects of Urbanization on the Magnitude and Frequency of Floods in Northeastern Illinois,
W80-00769 4C

ALMASSY, E.
Methods for Estimating Ground Water Resources and the Balance of Subsurface Waters,
W80-00440 6B

ANDERSON, D. E.
Detailed Structure of pH in Hydrometeors,
W80-00616 2K

ANDERSON, T. W.
Statistical Summaries of Arizona Streamflow Data,
W80-00771 2E

ARLOSOROFF, S.
Israel- A Model of Efficient Utilization of a Country's Water Resources,
W80-00471 6E

ARNER, D. H.
The Effects of Channelization on Furbearers and Furbearer Habitat,
W80-00800 5C

ARNOTT, G. H.
Acute Toxicity of Copper, Cadmium and Zinc to Three Species of Marine Copepod,
W80-00679 5A

ASTON, A. R.
Rainfall Interception by Eight Small Trees,
W80-00744 2I

AUSTIN, R. S.
A Compact, Low-Cost Circuit for Reading Four-Electrode Salinity Sensors,
W80-00752 2G

BADOWSKA, K.
The Effect of Intense Fertilization on Migration of Nitrogen Compounds in Soil,
W80-00508 5C

Significance of Sorption Properties of Soils in Predicting the Migration of Nitrogen Compounds into Natural Waters,
W80-00510 5C

BAGWELL, G. H.
Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00634 6G

Summary: Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00633 6G

BAILEY, R. W.
Dividing-Flow Manifolds with Square-Edged Laterals,
W80-00582 8B

BALEK, J.
Hydrological and Geochemical Mass Balance in Small Forested and Agricultural Basins,
W80-00703 2A

BALLANTYNE, A. K.
Measurement of Apparent Electrical Conductivity of Soils by an Electromagnetic Induction Probe to Aid Salinity Surveys,
W80-00750 2G

BARDSLEY, W. E.
Note on the Distribution of Flood Maxima for Random Sample Size,
W80-00611 2E

BAREL, D.
Phosphorus Cycling in Alaskan Coastal Tundra: A Hypothesis for the Regulation of Nutrient Cycling,
W80-00503 5C

BARICA, J.
Oxygen Depletion and Winterkill Risk in Small Prairie Lakes Under Extended Ice Cover,
W80-00668 5A

BARSDATE, R. J.
Phosphorus Cycling in Alaskan Coastal Tundra: A Hypothesis for the Regulation of Nutrient Cycling,
W80-00503 5C

BARTON, J. L.
Effectiveness of Sand Filters for Bacteriophage Escherichia Coli T1 Removal Using Calcium as an Aid,
W80-00493 5D

BATES, M. H.
The Effects of pH on the Aluminum, Iron and Calcium Phosphate Fractions of Lake Sediments,
W80-00588 2J

BATTIKHI, A.
Casing and Leak Depths, and Solute Travel Times to Wells,
W80-00579 5B

BEATTIE, B. R.
Urban Residential Demand for Water in the United States,
W80-00495 6D

BEHNKE, A.
Environmental Observations of a Riparian Ecosystem During Flood Season,
W80-00691 2E

BEHRENDT, H.
A Mathematical Ecosystem Model Applicable to Shallow Water Bodies,
W80-00711 2L

BEITINGER, T. L.
Growth Rates and Temperature Selection of Bluegill, Lepomis Macrochirus,
W80-00654 5C

BEJCEK, R. M.
Effects of Urbanization on the Magnitude and Frequency of Floods in Northeastern Illinois,
W80-00769 4C

BELLINGER, D.
River Basin Planning in Canada,
W80-00472 6A

BENAYOUN, G.
Body Burden of Chromium, Copper, Cadmium and Lead in the Neustonic Copepod Anomalocera Patersoni (Pontellidae) Collected from the Mediterranean Sea,
W80-00665 5A

BENEDEK, P.
Environmental Aspects of Pollution Control in Hungary,
W80-00441 6A

BENIJTS, F.
The Biochemical Composition of the Larvae of Two Strains of Artemia Salina (L.) Reared on two Different Algal Foods,
W80-00502 5C

BENNDORF, J.
New Aspects of the Consideration of Feedback Mechanisms in an Ecological Model of the Pelagic Zone,
W80-00715 2H

BENSON, L. J.
Water Usage Profile-Fort Carson Co.,
W80-00494 6D

BERESFORD, J. D.
Evaporation from Vegetation in Landscapes Developing Secondary Salinity Using the Ventilated-Chamber Technique, I. Comparative Transpiration from Juvenile Eucalyptus Above Saline Groundwater Seeps,
W80-00755 2I

BERGMANN, F.
Examples of the Organization of Self-Administration in the Water Economy of the Federal Republic of Germany,
W80-00470 6E

BERMAN, T.
Seasonal Changes in the Spectral Composition of Downwelling Irradiance in Lake Kinneret (Israel),
W80-00629 2H

BERNARD, B. B.
Chemical Aspects of a Brine Pool at the East Flower Garden Bank, Northwestern Gulf of Mexico,
W80-00626 2K

BHATTACHARYA, R. N.
Foundation Theories of Solute Transport in Porous Media: A Critical Review,
W80-00606 2A

BHUSHAN, L. S.
Conservation Bench Terraces for Rice in a Subhumid Climate,
W80-00595 3F

BITTON, G.
Transport of Viruses Through Organic Soils and Sediments,
W80-00584 5E

BLAGA, O.
The Long-Term National Programme for River Basin Development, Basis of the Water Management Policy in Romania,
W80-00450 6A

BLANCHAR, R. W.
Impact of Irrigation Water Salinity on Soil Runoff Water and Groundwater in Missouri,
W80-00635 3C

BLANCHARD, H. E. JR.
A Preliminary Appraisal of the Impact of Agriculture on Ground-Water Availability in Southwest Georgia,
W80-00770 4B

BLEVINS, R. L.
Soil Water in Coarse Fragments,
W80-00592 2G

BOES, M.
The Biocenotic Model,
W80-00707 5B

BOISVERT, R. N.
Flood Insurance or Disaster Loans: An Economic Evaluation,
W80-00492 6B

BONACCI, O.
Influence of Turbulence on the Accuracy of Discharge Measurements in Natural Streamflows,
W80-00745 2E

BONELL, M.
A Statistical Method for Modelling the Fate of Rainfall in a Tropical Rainforest Catchment,
W80-00748 2E

BONNET, M.
Natural Control of the Chemical Composition of Water During the Infiltration Process--First Results (Acquisition de la Composition Chimique de L'Eau au Cours de L'Infiltration en Milieu Naturel--Premiers Resultats D'Une Etude Experimentale),
W80-00719 5B

BOONE, S. G.
Water, Food, and Fiber,
W80-00455 3F

BORTLESON, G. C.
Comparison of Selected Cultural, Physical, and Water-Quality Characteristics of Lakes in Washington,
W80-00766 2H

BOSWORTH, W.
Modified Venture Suction Sampler for Collecting Asiatic Clams,
W80-00787 5A

BOTHWELL, P. D.
A Comparison of Dynamic and Static Head Space and Solvent Extraction Techniques for the Determination of Trihalomethanes in Water,
W80-00617 5A

BOTT, J. B.
Development of a Chlorine Resistant Reverse Osmosis Membrane and Porous Membrane Supports,
W80-00487 3A

BOTT, T. L.
Photooxidation Products of a Fuel Oil and Their Antimicrobial Activity,
W80-00671 5B

BOWERS, D.
Shelf Sea Fronts' Adjustments Revealed by Satellite IR Imagery,
W80-00603 2L

BOYD, C. E.
Water Quality in Channel Catfish Production Ponds,
W80-00619 5A

BOYD, M. J.
A Storage Routing Model Based on Catchment Geomorphology,
W80-00590 2E

BRAKE, A. M.
The Use of Chironomid Pupal Exuviae in the Surveillance of Sewage Pollution Within a Drainage System,
W80-00794 5A

BRIGHT, T. J.
Chemical Aspects of a Brine Pool at the East Flower Garden Bank, Northwestern Gulf of Mexico,
W80-00626 2K

BRINKHUIS, B. H.
The Impact of Dredged Holes on Oxygen Demand in the Lower Bay, New York Harbor,
W80-00694 4C

BROOKS, J. M.
Chemical Aspects of a Brine Pool at the East Flower Garden Bank, Northwestern Gulf of Mexico,
W80-00626 2K

BROOKS, J. S.
Guidelines for Urban Development in Louisiana's Coastal Wetlands,
W80-00547 4C

BROWNE, K.
Federal Tax Incentives for Private Environmental Planning,
W80-00496 6E

BRUSCHER, D. B.
Phytoplankton in the Fox Chain of Lakes,
W80-00686 5C

BURNESS, H. S.
Appropriative Water Rights and Efficient Allocation of Resources,
W80-00548 6E

BUSE, A.
A Survey of the Biota, Environment and Use for Recreation of Twelve Lakes in Snowdonia,
W80-00699 5C

BYER, P. H.
Screening Objectives and Uncertainties in Water Resources Planning,
W80-00551 6A

CAMERON, D. R.
Measurement of Apparent Electrical Conductivity of Soils by an Electromagnetic Induction Probe to Aid Salinity Surveys,
W80-00750 2G

CANO, G. J.
Water Law and Legislation: How to use them to Obtain Optimum Results from Water Resources,
W80-00428 6E

CAPOBIANCO, J. A.
Effects of Treated Effluent on a Natural Marsh,
W80-00677 5B

CARMACK, E. C.
Importance of Lake-River Interaction on Seasonal Patterns in the General Circulation of Kamloops Lake, British Columbia,
W80-00631 2H

CARRIERE, A.
Simulation Model of the Evolution of the Chemical Composition of a Mineral-Solution System and its Applications (Modele de Simulation de L'Evolution de la Composition Chimique d'un Systeme Mineraux-Solution et ses Applications),
W80-00721 5A

CAULFIELD, H. P.
Water USA: 1776-1976,
W80-00486 6E

CHAINARONG, L.
Water for Domestic Use in Rural Areas - Thailand,
W80-00448 6D

CHALON, E.
Effects of the Construction of a Broad Waterway on the Water Quality of the Doubs (Effets de la Canalisation a Grand Gabarit sur la Qualite des Eaux du Doubs),
W80-00704 5B

CHAN, K.-Y.
Effects of Bottom Sediments on the Survival of Enterobacter Aerogenes in Seawater,
W80-00662 5A

CHANDLER, J. H. JR.
Toxicity of Fishery Chemicals to the Asiatic Clam, Corbicula Manilensis,
W80-00785 5A

CHAPIN, F. S. III
Phosphorus Cycling in Alaskan Coastal Tundra: A Hypothesis for the Regulation of Nutrient Cycling,
W80-00503 5C

CHARBENEAU, R. J.
Modeling Groundwater Flow Fields Containing Point Singularities: A Technique for Singularity Removal,
W80-00609 2F

CHAU, Y. K.
Measurement of Complexing Materials Excreted from Algae and Their Ability to Ameliorate Copper Toxicity,
W80-00667 5A

CHEN, Y. H.
Geomorphic Study of Upper Mississippi River,
W80-00585 2E

CHERVIN, M. B.
The Production and Fate of Phytoplankton Size Fractions in the Plume of the Hudson River, New York Bight,
W80-00628 2L

CHERY, D. L. JR.
An Application Runoff Model Strategy for Ungaged Watersheds,
W80-00728 2E

CHIEN, P. K.
Uptake, Binding and Clearance of Divalent Cadmium in Glycera Dibranchiata (Annelida: Polychaeta),
W80-00664 5A

CHIU, S. Y.
Long-Term Availability of Water Resources for Energy Development in the Central United States,
W80-00499 6D

CHURCH, M.
Turbulent Flow in a Depth-Limited Boundary Layer,
W80-00741 8B

CHURCHILL, A. C.
Uptake of Cadmium by the Eelgrass Zostera Marina,
W80-00789 5A

CLARK, J. M.
Metabolism of Toxaphene by Aquatic Sediment and a Camphor-Degrading Pseudomonad,
W80-00511 5C

CLARK, S. D.
Inter-State Rivers in Australia,
W80-00461 6E

CLARKE, A. J.
On the Generation of the Seasonal Coastal Upwelling in the Gulf of Guinea,
W80-00608 2L

CLAUS, C.
The Biochemical Composition of the Larvae of Two Strains of Artemia Salina (L.) Reared on two Different Algal Foods,
W80-00502 5C

CLYDE, C. G.
An Application Runoff Model Strategy for Ungaged Watersheds,
W80-00728 2E

COBB, G. D.
Water USA: 1776-1976,
W80-00486 6E

COHON, J.
The Mathematical Programming Screening Model,
W80-00559 6A

The Mathematical Programming Sequencing Model,
W80-00562 6A

Outputs of the Models,
W80-00565 6A

COOKE, W. J.
Responses of Marine Fouling Communities to Sewage Abatement in Kaneohe Bay, Oahu, Hawaii,
W80-00791 5B

CORDERY, I.
A Storage Routing Model Based on Catchment Geomorphology,
W80-00590 2E

CORKETT, C. J.
Effects of Kuwait Oils on Feeding Rates of Copepods,
W80-00666 5A

CRAIG, J. L.
U.S. Inland Water Transportation,
W80-00473 6E

CRANE, R. G.
Snow and Ice Data Sets for Climate and Water Resource Studies with Particular Reference to North America,
W80-00567 2C

CRUZ, R. R.
Annual Water-Resources Review, White Sands Missile Range, New Mexico, 1978,
W80-00764 4D

CULP, G.
Environmental Pollution Control Alternatives: Municipal Wastewater,
W80-00544 5D

CURRY, K. D.
The Importance of Tributary Streams to the Reproduction of Catostomios and Sauger,
W80-00637 6G

CUSHMAN, J. H.
A Galerkin in Time, Linearized Finite Element Model of 2-Dimensional Unsaturated Porous Media Drainage,
W80-00753 2G

D'ELIA, C. F.
Growth and Competition of the Marine Diatoms Phaeodactylum Tricornutum and Thalassiosira Pseudonana, I. Nutrient Effects,
W80-00515 5C

DALEY, R. J.
Importance of Lake-River Interaction on Seasonal Patterns in the General Circulation of Kamloops Lake, British Columbia,
W80-00631 2H

DANELL, K.
Reduction of Aquatic Vegetation Following the Colonization of a Northern Swedish Lake by the Muskrat, Ondatra Zibethica,
W80-00513 5C

DANIEL, T. C.
Sediment and Nutrient Yield from Residential Construction Sites,
W80-00622 5B

DANIELSON, L. E.
An Analysis of Residential Demand for Water Using Micro Time-Series Data,
W80-00599 6D

DAVIES, R. D.
Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00634 6G

Summary: Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00633 6G

DAVIS, G. H.
Current Methodologies for the Collection and Dissemination of Water Resources Data in the United States,
W80-00474 7A

DAWSON, W. F.
Temperature-Monitoring and Safety-Control Device,
W80-00783 5A

DE BACKER, L. W.
Physical Components of the Diffusivity Coefficient,
W80-00754 2G

Relations Between Geometrical Properties of Glass Beads Media and Their Main Psi(Theta) Hysteresis Loops,
W80-00598 2G

DE FLORA, S.
Survey of the Pollution in a Coastal Area of the Tyrrhenian Sea. Aerial Photography, Physico-Chemical and Microbiological Investigations and Mutagenic Monitoring,
W80-00796 5A

DE JONG, E.
Measurement of Apparent Electrical Conductivity of Soils by an Electromagnetic Induction Probe to Aid Salinity Surveys,
W80-00750 2G

DE RENZI, G. P.
Survey of the Pollution in a Coastal Area of the Tyrrhenian Sea. Aerial Photography, Physico-Chemical and Microbiological Investigations and Mutagenic Monitoring,
W80-00796 5A

DEHN, W. S.
Inadequacies in Archived Sea Ice Data,
W80-00577 2C

DEJA, A.
Water Law and Its Application in Poland,
W80-00443 6E

DENOYELLES JR, F.
Phytoplankton Succession in Nutrient Enriched Experimental Ponds As Related to Changing Carbon, Nitrogen, and Phosphorus Conditions,
W80-00517 5C

DERIEMER, K.
Toxicity and Pharmacology of Extracts from Dorid Nudibranchs,
W80-00673 5A

DESORMEAU, C. J.
Mathematical Modeling of Phytoplankton Kinetics with Application to Two Alpine Lakes,
W80-00522 5C

DEVOL, A. H.
Estimates of Vertical Eddy Diffusion Through the Thermocline from Phytoplankton Nitrate Uptake Rates in the Mixed Layer of the Eastern Tropical Pacific,
W80-00630 2L

DEWREEDE, R. E.
The Effects of Emergence and Submergence on the Photosynthesis and Respiration of Marine Macrophytes,
W80-00514 5C

DION, N. P.
Comparison of Selected Cultural, Physical, and Water-Quality Characteristics of Lakes in Washington,
W80-00766 2H

DISKIN, M. H.
Some Dimensional Considerations in the Unit Hydrograph Theory,
W80-00591 2E

DOLLARD, E. M.
Integration of Residual Waste Management with Water Quality Management,
W80-00526 6E

DOMOKOS, M.
Restriction of Supply and Risk in Water Supply Systems,
W80-00442 6C

DOSSO, M.
Simulation Model of the Evolution of the Chemical Composition of a Mineral-Solution System and its Applications (Modele de Simulation de L'Evolution de la Composition Chimique d'un Systeme Mineraux-Solution et ses Applications),
W80-00721 5A

DOTTAVIO, F. D.
Socio-Economic Relationships for Water-Based Recreation Involvement in Indiana,
W80-00636 6B

DUBINSKY, Z.
Seasonal Changes in the Spectral Composition of Downwelling Irradiance in Lake Kinneret (Israel),
W80-00629 2H

DUDLEY, D. R.
Concentration and Sources of Fecal and Organic Pollution in an Agricultural Watershed,
W80-00687 5A

DUEDALL, I. W.
The Lower Bay Complex,
W80-00695 2J

DUNNE, T.
Sediment Yield and Land Use in Tropical Catchments,
W80-00746 2J

DUXBURY, A. C.
Upwelling and Estuary Flushing,
W80-00632 2L

EBLE, A. F.
Integration of Thermal and Food Processing Residuals into a System for Commercial Culture of Freshwater Shrimp. (Power Plant Waste Heat Utilization in Aquaculture)., Volume II,
W80-00497 3C

EL GAZZAR, A. M.
Wastewater as a Source of Nutrients and Water for Hydroponic Crop Production in Arid Regions,
W80-00642 5F

ELLIOTT, A. J.
Low-Frequency Sea Level and Current Fluctuations Along the Coast of Northwest Italy,
W80-00742 2L

ELORANTA, J.
Adaptation of the EPAECO Model to a Lake in Central Finland,
W80-00710 2L

EVANS, R. L.
Phytoplankton in the Fox Chain of Lakes,
W80-00686 5C

EXNER, M. E.
Chemical Seepage from a Tail Water Recovery Pit to Adjacent Ground Water,
W80-00621 5B

FABRIS, G. J.
Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

FACET, T.
The Mathematical Programming Screening Model,
W80-00559 6A

The Mathematical Programming Sequencing Model,
W80-00562 6A

Outputs of the Models,
W80-00565 6A

FADL, A. E.
A Modified Permeameter for Measuring Hydraulic Conductivity of Soils,
W80-00614 2G

FALK-PETERSEN, I-B.
Toxic Effects of Aqueous Extracts of Ekofisk Crude Oil, Crude Oil Fractions, and Commercial Oil Products on the Development of Sea Urchin Eggs,
W80-00798 5A

FARADAY, W. E.
Uptake of Cadmium by the Eelgrass Zostera Marina,
W80-00789 5A

FERGUSON, R. L.
Distribution of Suspended Bacteria in Neritic Waters South of Long Island During Stratified Conditions,
W80-00627 2L

FERREIRA, J. T.
Comparison of Anesthetic Potency of Benzocaine Hydrochloride and MS-222 in Two Freshwater Fish Species,
W80-00784 5A

FESSL, K.
Computerized Optimization of Water Releases from Reservoirs,
W80-00445 4A

FILECCIA, R. J.
Water Usage Profile-Fort Carson Co.,
W80-00494 6D

FILOTTI, A.
The Long-Term National Programme for River Basin Development, Basis of the Water Management Policy in Romania,
W80-00450 6A

FINDLAY, B. F.
Archiving and Mapping of Canadian Snow Cover Data,
W80-00574 2C

FLINT, R. F.
Floods of December 1978 in Kentucky,
W80-00758 2E

FOSTER, H. S. JR.
Urban Residential Demand for Water in the United States,
W80-00495 6D

FOX, I. K.
International River Basin Co-Operation: The Lessons from Experience,
W80-00430 6A

FOX, R. L.
Development of a Chlorine Resistant Reverse Osmosis Membrane and Porous Membrane Supports,
W80-00487 3A

FRANK, M.
Sea Ice Ridging Over the Alaskan Continental Shelf,
W80-00738 2C

FRAY, C. T.
Textural Properties of Surficial Sediments of Lower Bay of New York Harbor,
W80-00696 2J

FREDERICKSON, L. H.
Floral and Faunal Changes in Lowland Hardwood Forests in Missouri Resulting from Channelization, Drainage, and Impoundment,
W80-00528 6G

FUHRMAN, F. A.
Toxicity and Pharmacology of Extracts from Dorid Nudibranchs,
W80-00673 5A

FUHRMAN, G. J.
Toxicity and Pharmacology of Extracts from Dorid Nudibranchs,
W80-00673 5A

GAL, S.
Optimal Management of a Multireservoir Water Supply System,
W80-00583 4A

GARDNER, R. R.
Coastal Zone Management In The United States,
W80-00478 6E

GARDNER, W. S.
Degradation of Selected Polycyclic Aromatic Hydrocarbons in Coastal Sediments: Importance of Microbes and Polychaete Worms,
W80-00613 5A

GARVINE, R. W.
Summertime Synoptic Variability of the Middle Atlantic Shelf Water/Slope Water Front,
W80-00740 2L

GASPERI-MAGO, R. R.
Microbial Effects on Soil Erodibility,
W80-00594 2J

GIFFORD, G. E.
Transport of Viruses Through Organic Soils and Sediments,
W80-00584 5E

GILMOUR, D. A.
A Statistical Method for Modelling the Fate of Rainfall in a Tropical Rainforest Catchment,
W80-00748 2E

GLIWICZ, Z.
Can Planktovorous Fish Keep in Check Planktonic Crustacean Populations. A Test of Size-Efficiency Hypothesis in Typical Polish Lakes,
W80-00505 5C

GLOVER, G. M.
Weak and Strong Acids in the Surface Waters of the Tovdal Region in S. Norway,
W80-00624 2K

GODIN, R. H.
Data Sources and Sea Ice Products of Fleet Weather Facility/Joint Ice Center, Suitland,
W80-00568 2C

GOLDBERG, V. M.
Methods of Ground-Water Protection from Pollution,
W80-00463 4B

GOODISON, B. E.
Archiving and Mapping of Canadian Snow Cover Data,
W80-00574 2C

GOW, A. J.
Ultrasonic Velocity Investigations of Crystal Anisotropy in Deep Ice Cores from Antarctica,
W80-00739 2C

GRANTHAM, R. G.
A Preliminary Appraisal of the Impact of Agriculture on Ground-Water Availability in Southwest Georgia,
W80-00770 4B

GRAY, C. B. J.
Importance of Lake-River Interaction on Seasonal Patterns in the General Circulation of Kamloops Lake, British Columbia,
W80-00631 2H

GRAY, M. H.
The Effects of Channelization on Furbearers and Furbearer Habitat,
W80-00800 5C

GRAYMAN, W.
Economic Parameters,
W80-00563 6B

Engineering and Cost Parameters,
W80-00564 6B

Outputs of the Models,
W80-00565 6A

GREENWOOD, E. A. N.
Evaporation from Vegetation in Landscapes Developing Secondary Salinity Using the Ventilated-Chamber Technique, I. Comparative Transpiration from Juvenile Eucalyptus Above Saline Groundwater Seeps,
W80-00755 2I

GREGORY, K. J.
Drainage Network Power,
W80-00725 8E

GRIFFIN, G. F.
Potential Ground Water Pollution from Sewage Sludge Application on Agricultural Land,
W80-00489 5G

GROMIEC, M. J.
Mass Transfer Models of Sorption and Desorption of Radionuclides by Aquatic Plants,
W80-00705 2A

GROVE, P.
Electric Fish as a Tool for Water Quality Assessment,
W80-00659 5A

GROVES, D. L.
An Analysis of Values for Development of Recreational Policy,
W80-00500 6A

GUILLARD, R. R. L.
Growth and Competition of the Marine Diatoms Phaeodactylum Tricornutum and Thalassiosira Pseudonana, I. Nutrient Effects,
W80-00515 5C

Unexpected Response to Vitamin B12 of Dominant Centric Diatoms from the Spring Bloom in the Gulf of Maine (Northeast Atlantic Ocean),
W80-00681 5C

GUPTA, V. K.
Foundation Theories of Solute Transport in Porous Media: A Critical Review,
W80-00606 2A

GUTTI, S. R.
Source Schematization Effects on Farfield Results,
W80-00723 2H

HABEGGER, L. J.
Long-Term Availability of Water Resources for Energy Development in the Central United States,
W80-00499 6D

HAFEZ, M.
The Environmental Impacts of the Aswan High Dam,
W80-00446 5C

HAGERHALL, B.
Deterioration of Water Quality Due to Long Range Transport of Air Pollution,
W80-00458 5G

HAJRAH, H. H.
Development of Water Resources and its Influence on the Ecology of Saudi Arabia,
W80-00640 6G

HAKANSSON, H.
The Diatomflora of a Small Stream Near Abisko (Swedish Lapland) and Its Annual Periodicity, Judged by Drift and Colonization,
W80-00516 5C

HALES, L. Z.
Tillamook Bay Entrance Refraction Study, Tillamook, Oregon,
W80-00501 8A

HALIBURTON, T. A.
Best Ways to Dewater Dredged Material,
W80-00733 2G

HANES, D. M.
Performance Analysis of Tethered Float Breakwater,
W80-00587 8B

HANSON, A.
Swedish Policy for Water Quality Protection,
W80-00454 6E

HANSON, C. T.
Soil Water in Coarse Fragments,
W80-00592 2G

HAPPEY-WOOD, C. M.
A Survey of the Biota, Environment and Use for Recreation of Twelve Lakes in Snowdonia,
W80-00699 5C

HARD, G. C.
Survey of Demersal Fish in Port Phillip Bay for Incidence of Neoplasia,
W80-00680 5A

HARDEE, J.
Stormwater-Runoff Data for a Commercial Area, Broward County, Florida,
W80-00772 4C

HARLEMAN, D. R. F.
Cooling Impoundments: Classification and Analysis,
W80-00580 2H

HARLEY, B.
Simulation Analyses: The Detailed Model,
W80-00561 2A

HARMS, V. W.
Dye-Vector Flow Visualization--Cooling Water Model,
W80-00586 8B

HARRIS, J. E.
Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

HARRISON, J. G.
Nephrocalcinosis in Rainbow Trout Salmo Gairdneri Richardson; The Effect of Exposure to Elevated CO2 Concentrations,
W80-00674 5A

HARRISON, P. J.
The Effects of Emergence and Submergence on the Photosynthesis and Respiration of Marine Macrophytes,
W80-00514 5C

HART, B. T.
Establishment of Quality Criteria for Water Use in Australia,
W80-00460 6E

HARTWELL, S. I.
Thermal Shock Resistance of Spot (Leiostomus Xanthurus) After Acclimation to Constant or Cycling Temperature,
W80-00652 5C

HATCHER, P. G.
Polychlorinated Biphenyls and Chlorinated Pesticides in Soils of the Everglades National Park and Adjacent Agricultural Areas,
W80-00618 5A

HAVERINEN, A.
Finnish Experiences in Water-Resources Planning and Management Policy,
W80-00451 6A

HAWS, D. A.
Long-Term Effects of Land Application of Domestic Wastewater: Vineland, New Jersey, Rapid Infiltration Site,
W80-00529 5E

HENDERSON-SELLERS, B.
Water Quality in Lentic Water Bodies (Lakes and Reservoirs),
W80-00717 2H

HERBLAND, A.
The Use of the Salinity Maximum of the Equatorial Undercurrent for Estimating Nutrient Enrichment and Primary Production in the Gulf of Guinea,
W80-00781 5C

HERSHFIELD, D. M.
Secular Trend in Extreme Rainfalls,
W80-00735 2B

HETTICK, O. C.
Flood Profiles Along the Cedar River, King County, Washington,
W80-00760 2E

HO, F. P.
Precipitable Water Over the United States. Volume II: Semimonthly Maxima,
W80-00698 2B

HOEG, S.
A Mathematical Ecosystem Model Applicable to Shallow Water Bodies,
W80-00711 2L

HOFFMAN, L.
Physiological Adaptations of Salmonid Fishes (Salmo clarki henshawi, Salmo gairdneri, and Oncorhynchus kisutch) to Alkaline Saline Water and Their Toxic Effects,
W80-00488 2H

HOLDWAY, D. A.
Chronic Toxicity of Vanadium to Flagfish,
W80-00795 5A

HOLLSTEIN, M. C.
Mutagenic Activity in Organic Wastewater Concentrates,
W80-00670 5A

HOLMES, R. L.
Extension of River Flow Records in Argentina from Long Tree-Ring Chronologies,
W80-00731 2E

HOLZAPFEL, C. W.
Comparison of Anesthetic Potency of Benzocaine Hydrochloride and MS-222 in Two Freshwater Fish Species,
W80-00784 5A

HOOKE, J. M.
An Analysis of the Processes of River Bank Erosion,
W80-00612 2J

HOOVER, L. J.
Long-Term Availability of Water Resources for Energy Development in the Central United States,
W80-00499 6D

HOPPE, E. R.
The United States Environmental Satellite Data Archives,
W80-00571 7B

HORAK, G.
Instream Flow Strategies for California,
W80-00532 6E

Instream Flow Strategies for Washington,
W80-00531 6E

HOSS, D. E.
Thermal Shock Resistance of Spot (Leiostomus Xanthurus) After Acclimation to Constant or Cycling Temperature,
W80-00652 5C

HOWE, C. W.
The Design and Evaluation of Institutional Arrangements for Water Planning and Management,
W80-00431 6E

HUDSON, H. E. JR.
Dividing-Flow Manifolds with Square-Edged Laterals,
W80-00582 8B

HUNT, J. W.
Algal Biochemical Tricks and Classification,
W80-00512 5C

HUNT, L. L.
Photooxidation Products of a Fuel Oil and Their Antimicrobial Activity,
W80-00671 5B

HUNTER, J. V.
Petroleum Hydrocarbons in Urban Runoff,
W80-00730 5B

IRWIN, G. A.
Water-Quality Assessment of Runoff from a Rural Highway Bridge Near Tallahassee, Florida,
W80-00767 5B

ITAZAWA, Y.
Effects of Oral Administration of Cadmium on Fish-V Effects on Calcium and Inorganic Phosphorus Excretion in the Carp,
W80-00663 5A

JANUSZKO, M.
The Influence of Fertilization on Phytoplankton in Ponds with Varied Development of Biocoenose,
W80-00509 5C

JARBOE, J.
Water Withdrawals in Illinois, 1978,
W80-00722 7C

JAYAWARDENA, A. W.
A Finite-Element Distributed Catchment Model, II. Application to Real Catchments,
W80-00749 2E

JENKINS, S. R.
Effectiveness of Sand Filters for Bacteriophage Escherichia Coli T1 Removal Using Calcium as an Aid,
W80-00493 5D

JENNE, R. L.
Snow and Ice Data Sets for Climate and Water Resource Studies with Particular Reference to North America,
W80-00567 2C

JENNINGS, J. R.
The Effect of Cadmium and Lead on the Growth of Two Species of Marine Phytoplankton with Particular Reference to the Development of Tolerance,
W80-00676 5A

JENNINGS, M. E.
Evaluation of a Digital Model for Estuarine Water Quality Simulation in Waste Allocation Studies,
W80-00761 5B

JEUNG, R. A.
Urban Stormwater Pollution: An Investigation of the Problem and Its Control,
W80-00525 5B

JEZESKI, J. J.
Impacts of a Large Recreational Development on Water Quality in a Semi-Primitive Environment,
W80-00498 5C

JIRKA, G. H.
Cooling Impoundments: Classification and Analysis,
W80-00580 2H

JOHNELS, A.
A History of Mercury Levels in Swedish Fauna,
W80-00649 5A

JOHNSON, C. B.
Influence of Surface Roughness and Clod Size and Stability on Soil and Water Losses,
W80-00593 2J

JOHNSTON, E.
Water Quality in Channel Catfish Production Ponds,
W80-00619 5A

JOLANKAI, G.
A Simple Eutrophication Model for the Bay of Keszthely, Lake Balaton,
W80-00712 2L

JONES, C. R.
Textural Properties of Surficial Sediments of Lower Bay of New York Harbor,
W80-00696 2J

JORDAN, P. R.
Determination of Peak Discharge from Rainfall Data for Urbanized Basins, Wichita, Kansas,
W80-00774 6A

JURAK, D.
Heat and Mass Exchange Coefficients for Open Water Surfaces,
W80-00714 2D

KAHALAS, H.
An Analysis of Values for Development of Recreational Policy,
W80-00500 6A

KALLIAUER, A.
Computerized Optimization of Water Releases from Reservoirs,
W80-00445 4A

KAMATANI, A.
Zinc Uptake in Marine Diatoms,
W80-00669 5A

KANTOR, M.
Non Conventional Water Resources: Some Advances in their Development,
W80-00429 3C

KAPPLE, G. W.
Digital Model of the Hollister Valley Ground-Water Basin, San Benito County, California,
W80-00756 6A

KARR, J. R.
Concentration and Sources of Fecal and Organic Pollution in an Agricultural Watershed,
W80-00687 5A

KELLER, R. F.
A Galerkin in Time, Linearized Finite Element Model of 2-Dimensional Unsaturated Porous Media Drainage,
W80-00753 2G

KELLY, P. M.
An Arctic Sea Ice Data Set, 1901-1956,
W80-00576 2C

KHORDIKAINEN, M. A.
The Main Directions of Hydrogeological Investigations for the Substantiation of Artificial Recharge,
W80-00468 2A

KIDD, R. E.
Ground-Water Management Techniques for the Control of Salt-Water Encroachment in Gulf-Coast Aquifers, A Summary Report,
W80-00490 2F

KIMBALL, A. W. JR.
A DMSP Near IR Sensor for Cloud/Snow Discrimination,
W80-00570 7B

KINDLER, J.
Polish Research Program for System-Oriented Regional Management of Water Resources,
W80-00444 6A

KING, F. D.
Estimates of Vertical Eddy Diffusion Through the Thermocline from Phytoplankton Nitrate Uptake Rates in the Mixed Layer of the Eastern Tropical Pacific,
W80-00630 2L

KINNUNEN, K. A. I.
Adaptation of the EPAECO Model to a Lake in Central Finland,
W80-00710 2L

KIRK, J. R.
Water Withdrawals in Illinois, 1978,
W80-00722 7C

KIRKHAM, D.
Casing and Leak Depths, and Solute Travel Times to Wells,
W80-00579 5B

A Galerkin in Time, Linearized Finite Element Model of 2-Dimensional Unsaturated Porous Media Drainage,
W80-00753 2G

KLAPOW, L. A.
Analysis of Toxicity Data for California Marine Water Quality Standards,
W80-00689 5C

KLAUDA, R. J.
Hepatomas in Atlantic Tomcod Microgadus Tomcod (Walbaum) Collected in the Hudson River Estuary in New York,
W80-00675 5B

KNOLL, J.
Physiological Adaptations of Salmonid Fishes (Salmo clarki henshawi, Salmo gairdneri, and Oncorhynchus kisutch) to Alkaline Saline Water and Their Toxic Effects,
W80-00488 2H

KNOLL, R.
Physiological Adaptations of Salmonid Fishes (Salmo clarki henshawi, Salmo gairdneri, and Oncorhynchus kisutch) to Alkaline Saline Water and Their Toxic Effects,
W80-00488 2H

KNOX, D.
Nephrocalcinosis in Rainbow Trout Salmo Gairdneri Richardson; The Effect of Exposure to Elevated CO2 Concentrations,
W80-00674 5A

KOCH, D. L.
Physiological Adaptations of Salmonid Fishes (Salmo clarki henshawi, Salmo gairdneri, and Oncorhynchus kisutch) to Alkaline Saline Water and Their Toxic Effects,
W80-00488 2H

KOELZER, V. A.
Irrigation Technology for Desert Land Reclamation,
W80-00641 3F

KOERNER, E. L.
Long-Term Effects of Land Application of Domestic Wastewater: Vineland, New Jersey, Rapid Infiltration Site,
W80-00529 5E

KOHNEN, H.
Ultrasonic Velocity Investigations of Crystal Anisotropy in Deep Ice Cores from Antarctica,
W80-00739 2C

KOK, G. J. G.
Energy Exchange Between Deep Lakes and the Atmosphere and the Consequences for the Wind-Mixed Layer Dynamics,
W80-00713 2L

KORN, S.
Sensitivity of Alaskan Freshwater and Anadromous Fishes to Prudhoe Bay Crude Oil and Benzene,
W80-00660 5A

KORZOUN, V.I.I.
World Water Balance and Water Resources of the Earth,
W80-00466 2A

KOYAMA, J.
Effects of Oral Administration of Cadmium on Fish-V Effects on Calcium and Inorganic Phosphorus Excretion in the Carp,
W80-00663 5A

KOZERSKI, H-P.
A Mathematical Ecosystem Model Applicable to Shallow Water Bodies,
W80-00711 2L

KROONTJE, W.
Physical Condition of a Davidson Clay Loam after Five Years of Heavy Poultry Manure Applications,
W80-00620 2G

KUKLA, G.
Accuracy of Snow and Ice Monitoring,
W80-00575 2C

KUO-CHUIN, WONG
An Assessment of the Effects of Bathymetric Changes Associated with Sand and Gravel Mining on Tidal Circulation in the Lower Bay of New York Harbor,
W80-00693 2J

KUZIN, A. K.
On Role of Administrative, Economic and Technological Measures in Protection of Surface and Subterranean Water Against Contamination and Depletion,
W80-00465 6E

LAI, L.
Environmental Observations of a Riparian Ecosystem During Flood Season,
W80-00691 2E

LALLY, N.
The United States Experience in Flood Plain Management,
W80-00459 6F

LAM, D. C. L.
Nutrient Exchange Between Volume Elements of Large Lakes,
W80-00716 2H

LAMARCHE, V. C. JR.
Extension of River Flow Records in Argentina from Long Tree-Ring Chronologies,
W80-00731 2E

LAMB, G. M.
Ground-Water Management Techniques for the Control of Salt-Water Encroachment in Gulf-Coast Aquifers, A Summary Report,
W80-00490 2F

LANDREAU, A.
Natural Control of the Chemical Composition of Water During the Infiltration Process--First Results (Acquisition de la Composition Chimique de L'Eau au Cours de L'Infiltration en Milieu Naturel--Premiers Resultats D'Une Etude Experimentale),
W80-00719 5B

LANDSBERG, H. E.
Detailed Structure of pH in Hydrometeors,
W80-00616 2K

LAROUSSI, C.
Physical Components of the Diffusivity Coefficient,
W80-00754 2G

LAROUSSI, CH.
Relations Between Geometrical Properties of Glass Beads Media and Their Main Psi(Theta) Hysteresis Loops,
W80-00598 2G

LARSON, R. A.
Photooxidation Products of a Fuel Oil and Their Antimicrobial Activity,
W80-00671 5B

LAUGHLIN, R. B. JR.
Interactive Effects of Salinity, Temperature and Polycyclic Aromatic Hydrocarbons on the Survival and Development Rate of Larvae of the Mud Crab Rhithropanopeus Harrisii,
W80-00790 5A

LEE, G. F.
Persistence of Chlorine in Cooling Water from Electric Generating Station,
W80-00581 5A

LEE, J.
Survey of Demersal Fish in Port Phillip Bay for Incidence of Neoplasia,
W80-00680 5A

LEE, R. F.
Degradation of Selected Polycyclic Aromatic Hydrocarbons in Coastal Sediments: Importance of Microbes and Polychaete Worms,
W80-00613 5A

LEFURGEY, A.
Foraminifera in Brackish-Water Ponds Designed for Waste Control and Aquaculture Studies in North Carolina,
W80-00523 5C

LEMARQUAND, D. G.
International River Basin Co-Operation: The Lessons from Experience,
W80-00430 6A

LEMKE, A. E.
Temperature-Monitoring and Safety-Control Device,
W80-00783 5A

LENTON, R.
Simulation Analyses: The Basic Model,
W80-00560 6A

LEONOV, A. V.
A Dynamic Model of the Chemical Nutrient System for Research of the Ecological Consequences in Natural Water,
W80-00701 5B

LEWIS, M.
Instream Flow Strategies for California,
W80-00532 6E

LEWIS, R. H.
Analysis of Toxicity Data for California Marine Water Quality Standards,
W80-00689 5C

LIDDLE, M. J.
A Survey of the Biota, Environment and Use for Recreation of Twelve Lakes in Snowdonia,
W80-00699 5C

LIJKLEMA, L.
Trace Analysis of Phosphates in Small Aqueous Volumes,
W80-00589 5A

LIN, S. D.
Phytoplankton in the Fox Chain of Lakes,
W80-00686 5C

LONG, B. L.
Boundary Waters Management,
W80-00480 6E

LOPER, B. R.
The Response of Coho Salmon and Guppies to 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) in Water,
W80-00651 5A

LOSEY, G. T.
Water-Quality Assessment of Runoff from a Rural Highway Bridge Near Tallahassee, Florida,
W80-00767 5B

LOW, P. F.
Nature and Properties of Water in Montmorillonite-Water Systems,
W80-00597 2G

LOZANSKY, V. R.
On Role of Administrative, Economic and Technological Measures in Protection of Surface and Subterranean Water Against Contamination and Depletion,
W80-00465 6E

LUCOSTIC, C. M.
Effects of Acid Mine Drainage on a Southwestern Pennsylvania Stream,
W80-00684 5A

LYON, P. A.
Chemical Seepage from a Tail Water Recovery Pit to Adjacent Ground Water,
W80-00621 5B

MACKINNON, P. K.
Snow and Ice Data Sets for Climate and Water Resource Studies with Particular Reference to North America,
W80-00567 2C

MAGNUSON, J. J.
Growth Rates and Temperature Selection of Bluegill, Lepomis Macrochirus,
W80-00654 5C

MAHMOUD, T. A.
A Water Quality Study of a Stretch of the River Tigris,
W80-00623 5A

MAJOR, D. C.
Economic Parameters,
W80-00563 6B

Planning Theory: Multiobjectives,
W80-00556 6A

MAJOR, P.
Methods for Estimating Ground Water Resources and the Balance of Subsurface Waters,
W80-00440 6B

MAK, C. Y.
Effects of Bottom Sediments on the Survival of Enterobacter Aerogenes in Seawater,
W80-00662 5A

MAKI, A. W.
Reduction of Nonionic Surfactant Toxicity by Secondary Treatment,
W80-00678 5A

MALIK, R. S.
Physical Components of the Diffusivity Coefficient,
W80-00754 2G

MALLETT, M. J.
The Survival of Smolts of Salmon Salmo Salar L. at Low Concentrations of Dissolved Oxygen,
W80-00655 5A

MALONE, T. C.
The Production and Fate of Phytoplankton Size Fractions in the Plume of the Hudson River, New York Bight,
W80-00628 2L

MANLY, B. F. J.
Note on the Distribution of Flood Maxima for Random Sample Size,
W80-00611 2E

MANNER, E. J.
Experiences in Joint Administration of Border Watercourses,
W80-00452 6A

MANNERING, J. V.
Influence of Surface Roughness and Clod Size and Stability on Soil and Water Losses,
W80-00593 2J

MARKHAM, W. E.
Mapping and Archiving of Canadian Sea Ice Data,
W80-00569 7C

MARKING, L. L.
Toxicity of Fishery Chemicals to the Asiatic Clam, Corbicula Manilensis,
W80-00785 5A

MARKS, D.
The Mathematical Programming Screening Model,
W80-00559 6A

The Mathematical Programming Sequencing Model,
W80-00562 6A

MARTIN, W. W.
Summertime Synoptic Variability of the Middle Atlantic Shelf Water/Slope Water Front,
W80-00740 2L

MATHERLY, J. E.
Water Usage Profile-Fort Carson Co.,
W80-00494 6D

MATHIAS, J. A.
Oxygen Depletion and Winterkill Risk in Small Prairie Lakes Under Extended Ice Cover,
W80-00668 5A

MATSUI, S.
Mass Transfer Models of Sorption and Desorption of Radionuclides by Aquatic Plants,
W80-00705 2A

MATSUMURA, F.
Metabolism of Toxaphene by Aquatic Sediment and a Camphor-Degrading Pseudomonad,
W80-00511 5C

MATTICE, J. S.
Modified Venture Suction Sampler for Collecting Asiatic Clams,
W80-00787 5A

MATTRAW, H. C. JR.
Stormwater-Runoff Data for a Commercial Area, Broward County, Florida,
W80-00772 4C

MATULICH, S. C.
Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00634 6G

Summary: Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated

Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00633 6G

MAUERSBERGER, P.
On the Theoretical Basis of Modelling the Quality of Surface and Subsurface Waters,
W80-00700 5B

MCBEAN, E.
Simulation Analyses: The Basic Model,
W80-00560 6A

MCCUEN, R. H.
Statistical Terminology: Definitions and Interpretation for Flood Peak Estimation,
W80-00729 2E

MCGILL, J. D.
The Use of Chironomid Pupal Exuviae in the Surveillance of Sewage Pollution Within a Drainage System,
W80-00794 5A

MCGILLIVARY, P. A.
Polychlorinated Biphenyls and Chlorinated Pesticides in Soils of the Everglades National Park and Adjacent Agricultural Areas,
W80-00618 5A

MCGUIRE, P. E.
Sediment and Nutrient Yield from Residential Construction Sites,
W80-00622 5B

MCKEE, M. E.
Development of a Chlorine Resistant Reverse Osmosis Membrane and Porous Membrane Supports,
W80-00487 3A

MCLAREN, J. B.
Hepatomas in Atlantic Tomcod Microgadus Tomcod (Walbaum) Collected in the Hudson River Estuary in New York,
W80-00675 5B

MCWHORTER, D. B.
Effects of In-Transit Water on Groundwater Mounds Beneath Circular and Rectangular Recharge Areas,
W80-00610 2F

MERRITT, M. L.
Evaluation of a Digital Model for Estuarine Water Quality Simulation in Waste Allocation Studies,
W80-00761 5B

MILLER, A. R.
Laboratory Simulation of the Gyre in the Alboran Sea,
W80-00743 2L

MILLER, B.
Sediment and Nutrient Yield from Residential Construction Sites,
W80-00622 5B

MILLER, R. A.
The Response of Coho Salmon and Guppies to 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) in Water,
W80-00651 5A

Stormwater-Runoff Data for a Commercial Area, Broward County, Florida,
W80-00772 4C

MITSCH, W. J.
Environmental Observations of a Riparian Ecosystem During Flood Season,
W80-00691 2E

MOHAMED, K. A.
The Projects for the Increase of the Nile Yield with Special Reference to Jonglei Project,
W80-00447 4A

MOLDAN, B.
Hydrological and Geochemical Mass Balance in Small Forested and Agricultural Basins,
W80-00703 2A

MOLDENHAUER, W. C.
Influence of Surface Roughness and Clod Size and Stability on Soil and Water Losses,
W80-00593 2J

MOLES, A.
Sensitivity of Alaskan Freshwater and Anadromous Fishes to Prudhoe Bay Crude Oil and Benzene,
W80-00660 5A

MOLLER, P.
Electric Fish as a Tool for Water Quality Assessment,
W80-00659 5A

MOMAL, D.
Effects of the Construction of a Broad Waterway on the Water Quality of the Doubs (Effets de la Canalisation a Grand Gabarit sur la Qualite des Eaux du Doubs),
W80-00704 5B

MOORES, C. N. K.
Summertime Synoptic Variability of the Middle Atlantic Shelf Water/Slope Water Front,
W80-00740 2L

MOON, T. C.
Effects of Acid Mine Drainage on a Southwestern Pennsylvania Stream,
W80-00684 5A

MORELLI, R. P.
Survey of the Pollution in a Coastal Area of the Tyrrhenian Sea. Aerial Photography, Physico-Chemical and Microbiological Investigations and Mutagenic Monitoring,
W80-00796 5A

MORI, K.
Effects of Artificial Eutrophication on the Metabolism of the Japanese Oyster Crassostrea Gigas,
W80-00792 5B

MORITA, Y.
Zinc Uptake in Marine Diatoms,
W80-00669 5A

MOSLEY, M. P.
Streamflow Generation in a Forested Watershed, New Zealand,
W80-00724 2E

MUDROCH, A.
Effects of Treated Effluent on a Natural Marsh,
W80-00677 5B

MULLER, F.
Efficacy, Uptake and Distribution of Different Herbicides in the Water Hyacinth,
W80-00519 5C

MULLER-HAECKEL, A.
The Diatomflora of a Small Stream Near Abisko (Swedish Lapland) and Its Annual Periodicity, Judged by Drift and Colonization,
W80-00516 5C

MUMPHREY, A. J. JR.
Guidelines for Urban Development in Louisiana's Coastal Wetlands,
W80-00547 4C

NATHWANI, J. S.
Rate Controlling Processes in the Release of Radium-226 from Uranium Mill Tailings, I. Leaching Study,
W80-00600 5B

Rate Controlling Processes in the Release of Radium-226 from Uranium Mill Tailings, II. Kinetic Study,
W80-00601 5B

NAYMIK, T. G.
The Application of a Digital Model for Evaluating the Bedrock Water Resources of the Maumee River Basin, Northwestern Ohio,
W80-00726 2F

NEFF, J. M.
Interactive Effects of Salinity, Temperature and Polycyclic Aromatic Hydrocarbons on the Survival and Development Rate of Larvae of the Mud Crab Rhithropanopeus Harrisii,
W80-00790 5A

NELSON, D. M.
Growth and Competition of the Marine Diatoms Phaeodactylum Tricornutum and Thalassiosira Pseudonana, I. Nutrient Effects,
W80-00515 5C

NELSON, W.
Instream Flow Strategies for California,
W80-00532 6E

Instream Flow Strategies for Washington,
W80-00531 6E

NEWSOM, J. D.
Lead and Mercury in Lesser Snow Geese Wintering in Louisiana,
W80-00799 5A

NICOLLE, K.
Ground Water Replenishment from Riverflow,
W80-00604 2F

NIELL, F. X.
Structure and Succession in Rocky Algal Communities of a Temperate Intertidal System,
W80-00504 5C

NIEMI, J. S.
Adaptation of the EPAECO Model to a Lake in Central Finland,
W80-00710 2L

NORRIS, L. A.
The Response of Coho Salmon and Guppies to 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) in Water,
W80-00651 5A

NOWELL, A. R. M.
Turbulent Flow in a Depth-Limited Boundary Layer,
W80-00741 8B

NUR, R.
The Effects of pH on the Aluminum, Iron and Calcium Phosphate Fractions of Lake Sediments,
W80-00588 2J

O'BRIEN, W.J.
Phytoplankton Succession in Nutrient Enriched Experimental Ponds As Related to Changing Carbon, Nitrogen, and Phosphorus Conditions,
W80-00517 5C

O'CONNORS, H. B.
The Lower Bay Complex,
W80-00695 2J

O'KANE, J. P.
On the Choice of Boundary Conditions for One-Dimensional Models of Estuarine Water Quality,
W80-00706 2L

O'LEARY, J. T.
Socio-Economic Relationships for Water-Based Recreation Involvement in Indiana,
W80-00636 6B

OLENIK, T. J.
Time Series Analysis of Ammonia in the Passaic River,
W80-00638 5C

OMOTI, U.
Use of Fluorescent Dyes to Mark the Pathways of Solute Movement Through Soils Under Leaching Conditions: 2. Field Experiments,
W80-00615 2G

OREGIONI, B.
Body Burden of Chromium, Copper, Cadmium and Lead in the Neustonic Copepod Anomalocera Patersoni (Pontellidae) Collected from the Mediterranean Sea,
W80-00665 5A

ORTIZ, N. V.
Effects of In-Transit Water on Groundwater Mounds Beneath Circular and Rectangular Recharge Areas,
W80-00610 2F

OTSON, R.
A Comparison of Dynamic and Static Head Space and Solvent Extraction Techniques for the Determination of Trihalomethanes in Water,
W80-00617 5A

OVERMAN, A. R.
Transport of Viruses Through Organic Soils and Sediments,
W80-00584 5E

PACES, T.
Hydrological and Geochemical Mass Balance in Small Forested and Agricultural Basins,
W80-00703 2A

PALMER, C. J.
Impact of Irrigation Water Salinity on Soil Runoff Water and Groundwater in Missouri,
W80-00635 3C

PALUMBO, A. V.
Distribution of Suspended Bacteria in Neritic Waters South of Long Island During Stratified Conditions,
W80-00627 2L

PARCHEVSKAYA, D. S.
Body Burden of Chromium, Copper, Cadmium and Lead in the Neustonic Copepod Anomalocera Patersoni (Pontellidae) Collected from the Mediterranean Sea,
W80-00665 5A

PARK, R. A.
A Model for Simulating Lake Ecosystems,
W80-00521 5C

PARKER, J. H.
The Lower Bay Complex,
W80-00695 2J

PARSONS, T. R.
Mixing an Enclosed, 1300 Cubic Meter Water Column: Effects on the Planktonic Food Web,
W80-00672 5A

PASCUCHI, J.
Economic Parameters,
W80-00563 6B

PEAKALL, D. B.
Trace Metals in Seaducks of the Fraser River Delta Intertidal Area, British Columbia,
W80-00657 5A

PECK, T. H.
Hepatomas in Atlantic Tomcod Microgadus Tomcod (Walbaum) Collected in the Hudson River Estuary in New York,
W80-00675 5B

PEEK, C. O.
Determination of Peak Discharge from Rainfall Data for Urbanized Basins, Wichita, Kansas,
W80-00774 6A

PENTLAND, R. L.
Boundary Waters Management,
W80-00480 6E

PERKINS, F. E.
Planning Theory: The Role of Mathematical Models in Water Resources Planning,
W80-00557 6A

PERROUX, K. M.
Absorption of Water by Soil: The Constant Flux Boundary Condition,
W80-00596 2G

PERSSON, P.-E.
The Source of Muddy Odor in Bream (Abramis Brama) from the Porvoo Sea Area (Gulf of Finland),
W80-00661 5A

PETRILLI, F. L.
Survey of the Pollution in a Coastal Area of the Tyrrhenian Sea. Aerial Photography, Physico-Chemical and Microbiological Investigations and Mutagenic Monitoring,
W80-00796 5A

PHARO, C. H.
Importance of Lake-River Interaction on Seasonal Patterns in the General Circulation of Kamloops Lake, British Columbia,
W80-00631 2H

PHILLIPS, C. R.
Rate Controlling Processes in the Release of Radium-226 from Uranium Mill Tailings, I. Leaching Study,
W80-00600 5B

Rate Controlling Processes in the Release of Radium-226 from Uranium Mill Tailings, II. Kinetic Study,
W80-00601 5B

PHILLIPS, D. J. H.
The Rock Oyster Saccostrea Glomerata as an Indicator of Trace Metals in Hong Kong,
W80-00793 5A

PHIPPEN, G. R.
The United States Experience in Flood Plain Management,
W80-00459 6F

PICHAKHCHI, I. D.
On Role of Administrative, Economic and Technological Measures in Protection of Surface and Subterranean Water Against Contamination and Depletion,
W80-00465 6E

PILGRIM, D. H.
A Storage Routing Model Based on Catchment Geomorphology,
W80-00590 2E

POLIKARPOV, G. G.
Body Burden of Chromium, Copper, Cadmium and Lead in the Neustonic Copepod Anomalocera Patersoni (Pontellidae) Collected from the Mediterranean Sea,
W80-00665 5A

POLLARD, L. D.
A Preliminary Appraisal of the Impact of Agriculture on Ground-Water Availability in Southwest Georgia,
W80-00770 4B

POPOV, E. G.
Hydrological Forecasting for Operational Planning and Management of Water Resources,
W80-00467 2E

POST, G.
Carbonic Acid Anesthesia for Aquatic Organisms,
W80-00786 5A

POTMAN, W.
Trace Analysis of Phosphates in Small Aqueous Volumes,
W80-00589 5A

PREJS, A.
Can Planktovorous Fish Keep in Check Planktonic Crustacean Populations. A Test of Size-Efficiency Hypothesis in Typical Polish Lakes,
W80-00505 5C

PRUDIC, D. E.
Recharge to Low-Level Radioactive-Waste Burial Trenches 11 Through 14, West Valley, New York,
W80-00775 5E

PRUPPACHER, H. R.
A Wind Tunnel Investigation of the Rate of Evaporation of Large Water Drops Falling at Terminal Velocity in Air,
W80-00602 2B

PRUS, T.
Experimental and Field Studies on Ecological Energetics of Asellus Aquaticus L. (Isopoda). Energy Budget of a Population in the Littoral Zone of Powsinskie Lake,
W80-00507 5C

QUADIR, A.
The Effects of Emergence and Submergence on the Photosynthesis and Respiration of Marine Macrophytes,
W80-00514 5C

QUINONES, F.
Floods of December 1978 in Kentucky,
W80-00758 2E

QUIRK, J. P.
Appropriative Water Rights and Efficient Allocation of Resources,
W80-00548 6E

RALPH, J. A.
Nephrocalcinosis in Rainbow Trout Salmo Gairdneri Richardson; The Effect of Exposure to Elevated CO2 Concentrations,
W80-00674 5A

RANDALL, A. C.
Ground Water in Dale Valley, New York,
W80-00768 4B

RAPPAPORT, S. M.
Mutagenic Activity in Organic Wastewater Concentrates,
W80-00670 5A

RASMUSSEN, R.
A Wind Tunnel Investigation of the Rate of Evaporation of Large Water Drops Falling at Terminal Velocity in Air,
W80-00602 2B

RASTETTER, E. B.
Responses of Marine Fouling Communities to Sewage Abatement in Kaneohe Bay, Oahu, Hawaii,
W80-00791 5B

RATHBUN, R. E.
Estimating the Gas and Dye Quantities for Modified Tracer Technique Measurements of Stream Reaeration Coefficients,
W80-00773 5B

RATIA, J. U.
Experiences in Joint Administration of Border Watercourses,
W80-00452 6A

READ, D. W. L.
Measurement of Apparent Electrical Conductivity of Soils by an Electromagnetic Induction Probe to Aid Salinity Surveys,
W80-00750 2G

RECKNAGEL, F.
New Aspects of the Consideration of Feedback Mechanisms in an Ecological Model of the Pelagic Zone,
W80-00715 2H

REDDY, C. V. G.
Some Observations on Pollutants of Velsao Bay (GOA),
W80-00688 5A

REDNER, B. D.
Acclimation to Ammonia by Tilapia Aurea,
W80-00653 5A

REQUEJO, A. G.
Polychlorinated Biphenyls and Chlorinated Pesticides in Soils of the Everglades National Park and Adjacent Agricultural Areas,
W80-00618 5A

RETTGER, M. J.
Flood Insurance or Disaster Loans: An Economic Evaluation,
W80-00492 6B

RHOADES, J. D.
A Compact, Low-Cost Circuit for Reading Four-Electrode Salinity Sensors,
W80-00752 2G

Inexpensive Four-Electrode Probe for Monitoring Soil Salinity,
W80-00751 2G

RICE, M. A.
Uptake, Binding and Clearance of Divalent Cadmium in Glycera Dibranchiata (Annelida: Polychaeta),
W80-00664 5A

RICE, S. D.
Sensitivity of Alaskan Freshwater and Anadromous Fishes to Prudhoe Bay Crude Oil and Benzene,
W80-00660 5A

RICHARD, M. G.
Mutagenic Activity in Organic Wastewater Concentrates,
W80-00670 5A

RICHARDS, R. H.
Nephrocalcinosis in Rainbow Trout Salmo Gairdneri Richardson; The Effect of Exposure to Elevated CO2 Concentrations,
W80-00674 5A

RICHARDSON, E. V.
Irrigation Technology for Desert Land Reclamation,
W80-00641 3F

RIEDEL, J. T.
Precipitable Water Over the United States. Volume II: Semimonthly Maxima,
W80-00698 2B

RIHA, M.
A Method of Aquifer Testing and Its Application to an Anisotropic Inhomogeneous Multiple Aquifer System,
W80-00727 2F

ROBINSON, D.
Accuracy of Snow and Ice Monitoring,
W80-00575 2C

ROED, K. H.
The Temperature Preference of the Three-Spined Stickleback, Gasterosteus Aculeatus L. (Pisces), Collected at Different Seasons,
W80-00797 5A

ROEMHILD, G.
Impacts of a Large Recreational Development on Water Quality in a Semi-Primitive Environment,
W80-00498 5C

ROGENMUSER, K.
Photooxidation Products of a Fuel Oil and Their Antimicrobial Activity,
W80-00671 5B

ROMAIRE, R. P.
Water Quality in Channel Catfish Production Ponds,
W80-00619 5A

ROTH, C.
On the Growth of Instabilities in Groundwater Due to Temperature and Salinity Gradients,
W80-00605 2F

RUBCHAK, I. Y.
Main Trends in Treatment of Municipal and Industrial Sewage in the USSR,
W80-00464 5D

RUBIN, A. J.
Reduction of Nonionic Surfactant Toxicity by Secondary Treatment,
W80-00678 5A

RUBIN, H.
On the Growth of Instabilities in Groundwater Due to Temperature and Salinity Gradients,
W80-00605 2F

RUDD, R. T.
Pollution Control in the Mining Industry in South Africa,
W80-00484 5G

RUST, W.
Environmental Observations of a Riparian Ecosystem During Flood Season,
W80-00691 2E

RUSU, C.
The Long-Term National Programme for River Basin Development, Basis of the Water Management Policy in Romania,
W80-00450 6A

SABATON, C.
Effects of the Construction of a Broad Waterway on the Water Quality of the Doubs (Effets de la Canalisation a Grand Gabarit sur la Qualite des Eaux du Doubs),
W80-00704 5B

SANDERS, J. G.
The Concentration and Speciation of Arsenic in Marine Macro-Algae,
W80-00658 5A

SANDERS, T. G.
Use of Water Quality Variables for Estimation of Water Quantity Characteristics,
W80-00709 2A

SANDERSON, E. W.
Water Withdrawals in Illinois, 1978,
W80-00722 7C

SASMAN, R. T.
Water Withdrawals in Illinois, 1978,
W80-00722 7C

SAX, R. I.
Silver Concentration in Rainwater from Seeded and Nonseeded Florida Cumuli: 1973-1975 Results,
W80-00736 2B

SCHAAE JR, J. C.
Simulation Analyses: The Basic Model,
W80-00560 6A

SCHAAKE JR, J. C.
Simulation Analyses: The Detailed Model,
W80-00561 2A

SCHAD, T.
Water USA: 1776-1976,
W80-00486 6E

SCHAEFER, D. H.
Ground-Water Conditions and Potential for Artificial Recharge in Lucerne Valley, San Bernardino County, California,
W80-00763 4B

SCHELLENBERGER, G.
A Mathematical Ecosystem Model Applicable to Shallow Water Bodies,
W80-00711 2L

SCHEUERMAN, P. R.
Transport of Viruses Through Organic Soils and Sediments,
W80-00584 5E

SCHILLER, G.
Computerized Optimization of Water Releases from Reservoirs,
W80-00445 4A

SCHILLINGER, J. E.
Impacts of a Large Recreational Development on Water Quality in a Semi-Primitive Environment,
W80-00498 5C

SCHMIDT, G.
Cost Structure in Drinking Water Supply and The Price Structures to be Derived For Them,
W80-00485

SCHNEIDER, S. R.
Satellite-Derived River Basin Snow-Cover Percentages: A New Data Base for Hydrologists,
W80-00572 7B

SCHOONBEE, H. J.
Comparison of Anesthetic Potency of Benzocaine Hydrochloride and MS-222 in Two Freshwater Fish Species,
W80-00784 5A

SCHROEDER, W. W.
Dispersion and Impact of Mobile River System Waters in Mobile Bay, Alabama,
W80-00491 2E

SCHUBEL, J. R.
Textural Properties of Surficial Sediments of Lower Bay of New York Harbor,
W80-00696 2J

SCHUBERT, S. A.
Main Trends in Treatment of Municipal and Industrial Sewage in the USSR,
W80-00464 5D

SCHWAB, C. R.
Chemical Aspects of a Brine Pool at the East Flower Garden Bank, Northwestern Gulf of Mexico,
W80-00626 2K

SEABURN, G. E.
Evaluation of a Digital Model for Estuarine Water Quality Simulation in Waste Allocation Studies,
W80-00761 5B

SEDDIK, M. M.
Water Resources and Land Reclamation in Egypt,
W80-00643 6B

SEYMOUR, R. J.
Performance Analysis of Tethered Float Breakwater,
W80-00587 8B

SHAFEI, S.
Water Resources and Land Reclamation in Egypt,
W80-00643 6B

SHAFER, B. A.
Landsat-Derived Snow Cover as a Forecast Tool in the Rio Grande Basin in Colorado,
W80-00573 2C

SHANK, R. L.
Reduction of Nonionic Surfactant Toxicity by Secondary Treatment,
W80-00678 5A

SHATA, A. A.
Application of Geoscientific Knowledge to Evaluation of Land and Water Resources in Some Desert Areas of Egypt,
W80-00639 6B

SHENOUDA, W. K.
The Environmental Impacts of the Aswan High Dam,
W80-00446 5C

SHERRILL, M. G.
Contamination Potential in the Silurian Dolomite Aquifer, Eastern Wisconsin,
W80-00757 5B

SHEW, R. L.
Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00634 6G

Summary: Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00633 6G

SHIMIZU, M.
Study of Metal Contents of Elasmobranch Fishes: Part I-Metal Concentration in the Muscle Tissues of a Dogfish, Squalus Mitsukurii,
W80-00685 5A

SHURBEN, D. G.
The Survival of Smolts of Salmon Salmo Salar L. at Low Concentrations of Dissolved Oxygen,
W80-00655 5A

SICKO-GOAD, L.
A Morphometric Study of Lead and Copper Effects on Diatoma Tenue Var. Elongatum (Bacillariophyta),
W80-00782 5A

SIDRANE, S. D.
Implementation Strategies for Public Law 92-500, Section 208,
W80-00524 6E

SIMO, T.
Environmental Aspects of Pollution Control in Hungary,
W80-00441 6A

SIMONS, D. B.
Geomorphic Study of Upper Mississippi River,
W80-00585 2E

SIMONS, T. J.
Nutrient Exchange Between Volume Elements of Large Lakes,
W80-00716 2H

SIMPSON, J. H.
Shelf Sea Fronts' Adjustments Revealed by Satellite IR Imagery,
W80-00603 2L

SINCLAIR, D. F.
A Statistical Method for Modelling the Fate of Rainfall in a Tropical Rainforest Catchment,
W80-00748 2E

SINCLAIR, R. A.
Water Withdrawals in Illinois, 1978,
W80-00722 7C

SINGBAL, S. Y. S.
Some Observations on Pollutants of Velsao Bay (GOA),
W80-00688 5A

SINGH, S. P.
Efficacy, Uptake and Distribution of Different Herbicides in the Water Hyacinth,
W80-00519 5C

SKOREPA, J.
Hydrological and Geochemical Mass Balance in Small Forested and Agricultural Basins,
W80-00703 2A

SMART, G. R.
Nephrocalcinosis in Rainbow Trout Salmo Gairdneri Richardson; The Effect of Exposure to Elevated CO2 Concentrations,
W80-00674 5A

SMILES, D. E.
Absorption of Water by Soil: The Constant Flux Boundary Condition,
W80-00596 2G

SMIT, G. L.
Comparison of Anesthetic Potency of Benzocaine Hydrochloride and MS-222 in Two Freshwater Fish Species,
W80-00784 5A

SMITH, C. E.
Hepatomas in Atlantic Tomcod Microgadus Tomcod (Walbaum) Collected in the Hudson River Estuary in New York,
W80-00675 5B

SMITH, L. S.
Microbiological Water Quality in Relation to Public Health,
W80-00482 3C

SMITH, L. W.
Degradation of Selected Polycyclic Aromatic Hydrocarbons in Coastal Sediments: Importance of Microbes and Polychaete Worms,
W80-00613 5A

SMITH, R. E.
An Application Runoff Model Strategy for Ungaged Watersheds,
W80-00728 2E

SOKOLOV, A. A.
World Water Balance and Water Resources of the Earth,
W80-00466 2A

SOMLYODY, L.
An Effort for Modelling the Transport of Micropollutants in Rivers,
W80-00702 5B

The Use and Limitations of a Two-Dimensional Mixing Model for Rivers,
W80-00708 5B

SOMMER, J.
Physiological Adaptations of Salmonid Fishes (Salmo clarki henshawi, Salmo gairdneri, and Oncorhynchus kisutch) to Alkaline Saline Water and Their Toxic Effects,
W80-00488 2H

SOMMERFELD, M. R.
Survey of Swimming Pool Algae of the Phoenix, Arizona, Metropolitan Area,
W80-00536 5C

SONNTAG, N. C.
Mixing an Enclosed, 1300 Cubic Meter Water Column: Effects on the Planktonic Food Web,
W80-00672 5A

SOUFI, S. M.
Wastewater as a Source of Nutrients and Water for Hydroponic Crop Production in Arid Regions,
W80-00642 5F

SPACIE, A.
The Importance of Tributary Streams to the Reproduction of Catostomios and Sauger,
W80-00637 6G

SPALDING, R. F.
Chemical Seepage from a Tail Water Recovery Pit to Adjacent Ground Water,
W80-00621 5B

SPENCER, D. W.
Technique for Estimating the Magnitude and Frequency of Floods in St. Louis County, Missouri,
W80-00762 2E

SPOONER, M. F.
Effects of Kuwait Oils on Feeding Rates of Copepods,
W80-00666 5A

SPOSITO, G.
Foundation Theories of Solute Transport in Porous Media: A Critical Review,
W80-00606 2A

SPRAGUE, J. B.
Chronic Toxicity of Vanadium to Flagfish,
W80-00795 5A

ST, J.
Foraminifera in Brackish-Water Ponds Designed for Waste Control and Aquaculture Studies in North Carolina,
W80-00523 5C

STAPLE, W. J.
Predicting Hysteretic Effects in Evaporation From Bare Soil,
W80-00732 2D

STATHAM, P. J.
Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

STAUB, N. J.
Water Usage Profile-Fort Carson Co.,
W80-00494 6D

STEELE, H. A.
Water USA: 1776-1976,
W80-00486 6E

STEVENS, R. J.
Evaluation of an Enzymatic Method for Orthophosphate Determination in Freshwaters,
W80-00625 5A

STICKNEY, R. R.
Acclimation to Ammonia by Tilapia Aurea,
W80-00653 5A

STOCKTON, C. W.
Extension of River Flow Records in Argentina from Long Tree-Ring Chronologies,
W80-00731 2E

STOERMER, E. F.
A Morphometric Study of Lead and Copper Effects on Diatoma Tenue Var. Elongatum (Bacillariophyta),
W80-00782 5A

STOFFEL, D.
Sediment and Nutrient Yield from Residential Construction Sites,
W80-00622 5B

STREET, R. L.
Modeling Groundwater Flow Fields Containing Point Singularities: A Technique for Singularity Removal,
W80-00609 2F

STROMGREN, T.
The Effect of Zinc on the Increase in Length of Five Species of Intertidal Fucales,
W80-00682 5B

STUART, D. G.
Impacts of a Large Recreational Development on Water Quality in a Semi-Primitive Environment,
W80-00498 5C

SUAREZ, J.
Economic Parameters,
W80-00563 6B

SUDAK, R. G.
Development of a Chlorine Resistant Reverse Osmosis Membrane and Porous Membrane Supports,
W80-00487 3A

SULLAVAN, J. N.
Floods of December 1978 in Kentucky,
W80-00758 2E

SULLIVAN , J. J.
Chemical Seepage from a Tail Water Recovery Pit to Adjacent Ground Water,
W80-00621 5B

SUMBAL, J.
Computation of the Advancement of Groundwater Pollution Due to Petroleum Products Originating from a Known Source of Contamination (Le Calcul de la Propagation de la Pollution des Eaux Souterraines par des Materiaux Huileux, Provenants D'une Source de la Pollution Connue),
W80-00720 5B

SUNADA, D. K.
Effects of In-Transit Water on Groundwater Mounds Beneath Circular and Rectangular Recharge Areas,
W80-00610 2F

SUROWIEC, S.
Water Law and Its Application in Poland,
W80-00443 6E

SWARTZ, S. M.
The Impact of Dredged Holes on Oxygen Demand in the Lower Bay, New York Harbor,
W80-00694 4C

SWIFT, D. G.
Unexpected Response to Vitamin B12 of Dominant Centric Diatoms from the Spring Bloom in the Gulf of Maine (Northeast Atlantic Ocean),
W80-00681 5C

SYCHEV, K. I.
The Main Directions of Hydrogeological Investigations for the Substantiation of Artificial Recharge,
W80-00468 2A

SYKES, R. M.
Reduction of Nonionic Surfactant Toxicity by Secondary Treatment,
W80-00678 5A

SZABO, S.
Restriction of Supply and Risk in Water Supply Systems,
W80-00442 6C

SZOLLOSI-NAGY, A.
A Simple Eutrophication Model for the Bay of Keszthely, Lake Balaton,
W80-00712 2L

SZPERLINSKI, Z.
The Effect of Intense Fertilization on Migration of Nitrogen Compounds in Soil,
W80-00508 5C

Significance of Sorption Properties of Soils in Predicting the Migration of Nitrogen Compounds into Natural Waters,
W80-00510 5C

TAGUCHI, M.
Study of Metal Contents of Elasmobranch Fishes: Part I-Metal Concentration in the Muscle Tissues of a Dogfish, Squalus Mitsukurii,
W80-00685 5A

TAKAHASHI, M.
Zinc Uptake in Marine Diatoms,
W80-00669 5A

TAKEDA, M.
Total and Methylmercury Levels in Three Species of Whelks,
W80-00656 5A

TALCOTT, R. E.
Mutagenic Activity in Organic Wastewater Concentrates,
W80-00670 5A

TAWFIK, F.
Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

TENORE, K. R.
Degradation of Selected Polycyclic Aromatic Hydrocarbons in Coastal Sediments: Importance of Microbes and Polychaete Worms,
W80-00613 5A

THOMAS, F. H.
The United States Experience in Flood Plain Management,
W80-00459 6F

THORNTON, E. B.
Energetics of Breaking Waves Within the Surf Zone,
W80-00737 2L

THUSS, M. F.
A Comparative Analysis of Multi-Source Water Supply Data for Pima County, Arizona,
W80-00644 6D

Large Array of Wastewater Reuse Options for Pima County, Arizona,
W80-00646 6B

Projected Water Use and Water Budget Calculations for Pima County, Arizona,
W80-00647 6B

Water Use Information for Pima County, Arizona,
W80-00645 7B

TODA, S.
Study of Metal Contents of Elasmobranch Fishes: Part I-Metal Concentration in the Muscle Tissues of a Dogfish, Squalus Mitsukurii,
W80-00685 5A

TOLLAN, A.
Deterioration of Water Quality Due to Long Range Transport of Air Pollution,
W80-00458 5G

TORGERSEN, T.
Isotopic Composition of River Runoff on the U.S. East Coast: Evaluation of Stable Isotope Versus Salinity Plots for Coastal Water Mass Identification,
W80-00607 2L

TROEH, F. R.
Microbial Effects on Soil Erodibility,
W80-00594 2J

TUCKER, W. B. III
Sea Ice Ridging Over the Alaskan Continental Shelf,
W80-00738 2C

TYLER, G.
A History of Mercury Levels in Swedish Fauna,
W80-00649 5A

UEDA, T.
Total and Methylmercury Levels in Three Species of Whelks,
W80-00656 5A

UHLER, R. B.
Dividing-Flow Manifolds with Square-Edged Laterals,
W80-00582 8B

UHLMANN, D.
New Aspects of the Consideration of Feedback Mechanisms in an Ecological Model of the Pelagic Zone,
W80-00715 2H

USENKO, V. S.
The Main Directions of Hydrogeological Investigations for the Substantiation of Artificial Recharge,
W80-00468 2A

VALDES, J.
Simulation Analyses: The Detailed Model,
W80-00561 2A

VAN DEN BERG, C. M. G.
Measurement of Complexing Materials Excreted from Algae and Their Ability to Ameliorate Copper Toxicity,
W80-00667 5A

VAN DEN BROEK, W. L. F.
A Seasonal Survey of Fish Populations in the Lower Medway Estuary, Kent, Based on Power Station Screen Samples,
W80-00650 5C

VAN ROBBROECK, T. P. C.
Inter Basin Water Transfers in South Africa,
W80-00483 6D

VAN ROOYEN, G. I.
Microbiological Water Quality in Relation to Public Health,
W80-00482 3C

VAN'T WOUDT, B. D.
Ground Water Replenishment from Riverflow,
W80-00604 2F

VANDEPUTTE, G.
The Biochemical Composition of the Larvae of Two Strains of Artemia Salina (L.) Reared on two Different Algal Foods,
W80-00502 5C

VERMA, A. P.
Source Schematization Effects on Farfield Results,
W80-00723 2H

VERMEER, K.
Trace Metals in Seaducks of the Fraser River Delta Intertidal Area, British Columbia,
W80-00657 5A

VICENS, G.
Outputs of the Models,
W80-00565 6A

VITALE, P.
Sand Bed Friction Factors for Oscillatory Flows,
W80-00734 2L

VOITURIEZ, B.
The Use of the Salinity Maximum of the Equatorial Undercurrent for Estimating Nutrient Enrichment and Primary Production in the Gulf of Guinea,
W80-00781 5C

WALD, L. Y.
U.S. Inland Water Transportation,
W80-00473 6E

WALLACE, A.
Wastewater as a Source of Nutrients and Water for Hydroponic Crop Production in Arid Regions,
W80-00642 5F

WALLER, R. M.
Ground-Water Appraisal for the Community of Kiryas Joel, Orange County, New York,
W80-00759 2A

WALLIS, P. M.
Sources, Transportation and Utilization of Dissolved Organic Matter in Groundwater and Streams,
W80-00530 2F

WALTER, G. R.
Ground-Water Management Techniques for the Control of Salt-Water Encroachment in Gulf-Coast Aquifers, A Summary Report,
W80-00490 2F

WATANABE, M.
Modelling of the Eutrophication Process in Lakes and Reservoirs,
W80-00718 2H

WEBB, A. H.
Weak and Strong Acids in the Surface Waters of the Tovdal Region in S. Norway,
W80-00624 2K

WEEKS, W. F.
Sea Ice Ridging Over the Alaskan Continental Shelf,
W80-00738 2C

WEIL, R. R.
Physical Condition of a Davidson Clay Loam after Five Years of Heavy Poultry Manure Applications,
W80-00620 2G

WENGEL, R. W.
Potential Ground Water Pollution from Sewage Sludge Application on Agricultural Land,
W80-00489 5G

WEST, L. D.
Lead and Mercury in Lesser Snow Geese Wintering in Louisiana,
W80-00799 5A

WEST, R. H.
Polychlorinated Biphenyls and Chlorinated Pesticides in Soils of the Everglades National Park and Adjacent Agricultural Areas,
W80-00618 5A

WESTERMARK, T.
A History of Mercury Levels in Swedish Fauna,
W80-00649 5A

WHIPPLE, W. JR.
Petroleum Hydrocarbons in Urban Runoff,
W80-00730 5B

WHITE, I.
Absorption of Water by Soil: The Constant Flux Boundary Condition,
W80-00596 2G

WHITE, J. K.
A Finite-Element Distributed Catchment Model, II. Application to Real Catchments,
W80-00749 2E

WHITE, N. D.
Statistical Summaries of Arizona Streamflow Data,
W80-00771 2E

WHITEHEAD, J. A. JR.
Laboratory Simulation of the Gyre in the Alboran Sea,
W80-00743 2L

WHITTAKER, J.
Ground Water Replenishment from Riverflow,
W80-00604 2F

WIEGEL, R. L.
Dye-Vector Flow Visualization--Cooling Water Model,
W80-00586 8B

WIENER, A.
Water Resources Development, and Management Planning in Arid Zones: Case History-Israel,
W80-00457 6A

WILD, A.
Use of Fluorescent Dyes to Mark the Pathways of Solute Movement Through Soils Under Leaching Conditions: 2. Field Experiments,
W80-00615 2G

WILLIAMS, D. T.
A Comparison of Dynamic and Static Head Space and Solvent Extraction Techniques for the Determination of Trihalomethanes in Water,
W80-00617 5A

WILLIAMS, R.
Survey of Demersal Fish in Port Phillip Bay for Incidence of Neoplasia,
W80-00680 5A

WILLIAMS, T. T.
Impacts of a Large Recreational Development on Water Quality in a Semi-Primitive Environment,
W80-00498 5C

WILLIAMSON, W. H.
The Response of Groundwater Systems to Drought,
W80-00462 4B

WILSEY, S.
Instream Flow Strategies for Washington,
W80-00531 6E

WILSON, M. W.
Drainage Areas of the Twelvepole Creek Basin, West Virginia, Big Sandy River Basin, West Virginia, Tug Fork Basin, Virginia, Kentucky, West Virginia,
W80-00765 7C

WILSON, R. E.
An Assessment of the Effects of Bathymetric Changes Associated with Sand and Gravel Mining on Tidal Circulation in the Lower Bay of New York Harbor,
W80-00693 2J

The Lower Bay Complex,
W80-00695 2J

WILSON, R. S.
The Use of Chironomid Pupal Exuviae in the Surveillance of Sewage Pollution Within a Drainage System,
W80-00794 5A

WINCKLER, G.
Rehabilitation of Catchment Areas in Mountain Regions,
W80-00469 4A

WISNIEWSKI, J.
Silver Concentration in Rainwater from Seeded and Nonseeded Florida Cumuli: 1973-1975 Results,
W80-00736 2B

WOLFLEY, B. F.
Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00634 6G

Summary: Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00633 6G

WONG, P. T. S.
Measurement of Complexing Materials Excreted from Algae and Their Ability to Ameliorate Copper Toxicity,
W80-00667 5A

WONG, S. H.
Effects of Bottom Sediments on the Survival of Enterobacter Aerogenes in Seawater,
W80-00662 5A

WONG, S. T.
A Dimensionally Homogeneous and Statistically Optimal Model for Predicting Mean Annual Flood,
W80-00747 2E

YAKOVLEV, S. V.
Main Trends in Treatment of Municipal and Industrial Sewage in the USSR,
W80-00464 5D

YASUDA, K.
Study of Metal Contents of Elasmobranch Fishes: Part I-Metal Concentration in the Muscle Tissues of a Dogfish, Squalus Mitsukurii,
W80-00685 5A

YEVJEVICH, V.
Use of Water Quality Variables for Estimation of Water Quantity Characteristics,
W80-00709 2A

YORKE, T. H.
Impact Assessment of Water Resource Development Activities: A Dual Matrix Approach,
W80-00550 6B

YOUNGBERG, B.
Application of the Aquatic Model Cleaner to a Stratified Reservoir System,
W80-00520 5C

ZACHMANN, D. W.
Effects of In-Transit Water on Groundwater Mounds Beneath Circular and Rectangular Recharge Areas,
W80-00610 2F

ZARKANELLAS, A. J.
The Effects of Pollution-Induced Oxygen Deficiency on the Benthos in Elefsis Bay, Greece,
W80-00690 5C

ZINGDE, M. D.
Some Observations on Pollutants of Velsao Bay (GOA),
W80-00688 5A

ZWALLY, H. J.
NASA Mapping Projects (Summary),
W80-00578 7C

ACADE
PHILA
WATER
Photo
Antim
W80-

ACADE
TECHN
The I
Dam,
W80-

ADELP
OF BIO
Uptal
Marin
W80-

ALABA
DAUPH
Dispe
Wate
W80-

ALASK
ARCTI
Phos
A H
Cycli
W80-

ALL-U
FOR P
On
Tech
and S
and I
W80-

ALL-U
OF HY
GEOL
The
tigati
charg
W80

ALL-U
OF HY
GEOL
Meth
lutio
W80

ALLE
CONS
IN.
Con
Pollu
W80

ARGO
AND I
Lon
Ener
State
W80

ARIZ
BOTA
Surv
nix,
W80

ARIZ
RING
Exte
from
W80

ARM
ANGE
A C
Sup
W80

ORGANIZATIONAL INDEX

ACADEMY OF NATIONAL SCIENCES OF PHILADELPHIA, AVONDALE, PA. STROUD WATER RESEARCH CENTER.
Photooxidation Products of a Fuel Oil and Their Antimicrobial Activity,
W80-00671 5B

ACADEMY OF SCIENTIFIC RESEARCH AND TECHNOLOGY, CAIRO (EGYPT).
The Environmental Impacts of the Aswan High Dam,
W80-00446 5C

ADELPHI UNIV., GARDEN CITY, NY. DEPT. OF BIOLOGY.
Uptake of Cadmium by the Eelgrass Zostera Marina,
W80-00789 5A

ALABAMA UNIV., DAUPHIN ISLAND. DAUPHIN ISLAND SEA LAB.
Dispersion and Impact of Mobile River System Waters in Mobile Bay, Alabama,
W80-00491 2E

ALASKA UNIV., FAIRBANKS. INST. OF ARCTIC BIOLOGY.
Phosphorus Cycling in Alaskan Coastal Tundra: A Hypothesis for the Regulation of Nutrient Cycling,
W80-00503 5C

ALL-UNION SCIENTIFIC RESEARCH INST. FOR PROTECTION OF WATERS (USSR).
On Role of Administrative, Economic and Technological Measures in Protection of Surface and Subterranean Water Against Contamination and Depletion,
W80-00465 6E

ALL-UNION SCIENTIFIC RESEARCH INST. OF HYDROGEOLOGY AND ENGINEERING GEOLOGY.
The Main Directions of Hydrogeological Investigations for the Substantiation of Artificial Recharge,
W80-00468 2A

ALL-UNION SCIENTIFIC RESEARCH INST. OF HYDROGEOLOGY AND ENGINEERING GEOLOGY, MOSCOW (USSR).
Methods of Ground-Water Protection from Pollution,
W80-00463 4B

ALLEN COUNTY SOIL AND WATER CONSERVATION DISTRICT, FORT WAYNE, IN.
Concentration and Sources of Fecal and Organic Pollution in an Agricultural Watershed,
W80-00687 5A

ARGONNE NATIONAL LAB., IL. ENERGY AND ENVIRONMENTAL SYSTEMS DIV.
Long-Term Availability of Water Resources for Energy Development in the Central United States,
W80-00499 6D

ARIZONA STATE UNIV., TEMPE. DEPT. OF BOTANY AND MICROBIOLOGY.
Survey of Swimming Pool Algae of the Phoenix, Arizona, Metropolitan Area,
W80-00506 5C

ARIZONA UNIV., TUCSON. LAB. OF TREE-RING RESEARCH.
Extension of River Flow Records in Argentina from Long Tree-Ring Chronologies,
W80-00731 2E

ARMY CORPS OF ENGINEERS, LOS ANGELES, CA.
A Comparative Analysis of Multi-Source Water Supply Data for Pima County, Arizona,
W80-00644 6D

Water Use Information for Pima County, Arizona,
W80-00645 7B

Large Array of Wastewater Reuse Options for Pima County, Arizona,
W80-00646 6B

Projected Water Use and Water Budget Calculations for Pima County, Arizona,
W80-00647 6B

Large Array of Water Conservation Strategies for Pima County, Arizona,
W80-00648 3D

ARMY ENGINEER DISTRICT, LOUISVILLE, KY.
Flood Plain Information: Ohio River, Hancock County, Kentucky,
W80-00537 2E

Flood Plain Information: Ohio River, Boone County, Kentucky,
W80-00539 2E

ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
Flood Plain Information: Bayou Bonfouca-Bayou Vincent W-14 Main Diversion Canal Doubloon Branch-French Branch, Slidell, Louisiana and Vicinity,
W80-00536 2E

Flood Plain Information: Baton Rouge, Louisiana, No. 5, Cypress Bayou and Tributaries,
W80-00540 2E

Flood Plain Information: Baton Rouge, Louisiana, No 4, Hurricane Creek, Monte Sano Bayou and Tributaries,
W80-00541 2E

ARMY ENGINEER DISTRICT, PITTSBURGH, PA.
Special Flood Hazard Information Report: Tygart River, Taylor County, West Virginia,
W80-00538 2E

ARMY ENGINEER WATERWAY EXPERIMENT STATION, VICKSBURG, MS. HYDRAULICS LAB.
Tillamook Bay Entrance Refraction Study, Tillamook, Oregon,
W80-00501 8A

ARMY TERRESTRIAL SCIENCES CENTER, HANOVER, NH.
Sea Ice Ridging Over the Alaskan Continental Shelf,
W80-00738 2C

Ultrasonic Velocity Investigations of Crystal Anisotropy in Deep Ice Cores from Antarctica,
W80-00739 2C

ASIAN INST. OF TECH., BANGKOK (THAILAND). DIV. OF HUMAN SETTLEMENTS DEVELOPMENTS.
A Dimensionally Homogeneous and Statistically Optimal Model for Predicting Mean Annual Flood,
W80-00747 2E

ATMOSPHERIC ENVIRONMENT SERVICE, DOWNSVIEW (ONTARIO).
Mapping and Archiving of Canadian Sea Ice Data,
W80-00569 7C

Archiving and Mapping of Canadian Snow Cover Data,
W80-00574 2C

AUBURN UNIV., AL. DEPT. OF CIVIL ENGINEERING.
Effectiveness of Sand Filters for Bacteriophage Escherichia Coli T1 Removal Using Calcium as an Aid,
W80-00493 5D

AUBURN UNIV., AL. DEPT. OF FISHERIES AND ALLIED AQUACULTURES.
Water Quality in Channel Catfish Production Ponds,
W80-00619 5A

AUSTRIAN ELECTRICAL INDUSTRIES, INC.
Computerized Optimization of Water Releases from Reservoirs,
W80-00445 4A

BAR-ILAN UNIV., RAMAT GAN (ISRAEL). DEPT. OF LIFE SCIENCES.
Seasonal Changes in the Spectral Composition of Downwelling Irradiance in Lake Kinneret (Israel),
W80-00629 2H

BENHAM-BLAIR AND AFFILIATES, INC., OKLAHOMA CITY, OK.
Long-Term Effects of Land Application of Domestic Wastewater: Vineland, New Jersey, Rapid Infiltration Site,
W80-00529 5E

BIGELOW LAB. FOR OCEAN SCIENCES, WEST BOOTHBAY HARBOR, ME.
Estimates of Vertical Eddy Diffusion Through the Thermocline from Phytoplankton Nitrate Uptake Rates in the Mixed Layer of the Eastern Tropical Pacific,
W80-00630 2L

BOCHUM (GERMANY, F.R.).
Cost Structure in Drinking Water Supply and The Price Structures to be Derived For Them,
W80-00485

BRISTOL UNIV. (ENGLAND). DEPT. OF ZOOLOGY.
The Use of Chironomid Pupal Exuviae in the Surveillance of Sewage Pollution Within a Drainage System,
W80-00794 5A

BRITISH COLUMBIA UNIV., VANCOUVER. DEPT. OF BOTANY.
The Effects of Emergence and Submergence on the Photosynthesis and Respiration of Marine Macrophytes,
W80-00514 5C

BRITISH COLUMBIA UNIV., VANCOUVER. INST. OF OCEANOGRAPHY.
Mixing an Enclosed, 1300 Cubic Meter Water Column: Effects on the Planktonic Food Web,
W80-00672 5A

BRITISH COLUMBIA UNIV. VANCOUVER. WESTWATER RESEARCH CENTRE.
International River Basin Co-Operation: The Lessons from Experience,
W80-00430 6A

BRUNSWICK JUNIOR COLL., GA.
Water Quality Investigation of Estuaries of Georgia, 1976,
W80-00553 2L

BUNDESMINISTERIUM FUER WIRTSCHAFT, BONN (GERMANY, F.R.)
Rehabilitation of Catchment Areas in Mountain Regions,
W80-00469 4A

BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, ORLEANS (FRANCE).
Natural Control of the Chemical Composition of Water During the Infiltration Process--First Results (Acquisition de la Composition Chimique de L'Eau au Cours de L'Infiltration en Milieu Naturel--Premiers Resultats D'Une Etude Experimentale),
W80-00719 5B

BUREAU OF RECLAMATION, WASHINGTON, DC.
Increasing Available Water Supplies Through Weather Modification and Desalination,
W80-00479 2B

CALIFORNIA STATE COLL., PA. DEPT. OF BIOLOGY.
Effects of Acid Mine Drainage on a Southwestern Pennsylvania Stream,
W80-00684 5A

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD, SACRAMENTO.
Analysis of Toxicity Data for California Marine Water Quality Standards,
W80-00689 5C

CALIFORNIA UNIV., BERKELEY. SCHOOL OF PUBLIC HEALTH.
Mutagenic Activity in Organic Wastewater Concentrates,
W80-00670 5A

CALIFORNIA UNIV., LIVERMORE. LAWRENCE LIVERMORE LAB.
The Application of a Digital Model for Evaluating the Bedrock Water Resources of the Maumee River Basin, Northwestern Ohio,
W80-00726 2F

CALIFORNIA UNIV., LOS ANGELES; AND AMERICAN UNIV., BEIRUT (LEBANON), AND ALEXANDRIA UNIV. (EGYPT).
Wastewater as a Source of Nutrients and Water for Hydroponic Crop Production in Arid Regions,
W80-00642 5F

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF ATMOSPHERIC SCIENCES.
A Wind Tunnel Investigation of the Rate of Evaporation of Large Water Drops Falling at Terminal Velocity in Air,
W80-00602 2B

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL AND ENVIRONMENTAL SCIENCES.
Foundation Theories of Solute Transport in Porous Media: A Critical Review,
W80-00606 2A

CANADA CENTRE FOR INLAND WATERS, BURLINGTON (ONTARIO).
Effects of Treated Effluent on a Natural Marsh,
W80-00677 5B

Nutrient Exchange Between Volume Elements of Large Lakes,
W80-00716 2H

CANADIAN WILDLIFE SERVICE, DELTA (BRITISH COLUMBIA).
Trace Metals in Seaducks of the Fraser River Delta Intertidal Area, British Columbia,
W80-00657 5A

CAULFIELD INST. OF TECH., VICTORIA (AUSTRALIA). WATER STUDIES CENTRE.
Establishment of Quality Criteria for Water Use in Australia,
W80-00460 6E

CENTRAL ELECTRICITY GENERATING BOARD, LEATHERHEAD (ENGLAND). RESEARCH LAB.
Weak and Strong Acids in the Surface Waters of the Tovdal Region in S. Norway,
W80-00624 2K

CENTRAL SOIL AND WATER CONSERVATION RESEARCH INST., AGRA (INDIA).
Conservation Bench Terraces for Rice in a Subhumid Climate,
W80-00595 3F

CHINESE UNIV. OF HONG KONG. DEPT. OF BIOLOGY.
Effects of Bottom Sediments on the Survival of Enterobacter Aerogenes in Seawater,
W80-00662 5A

CITY COLL., NEW YORK.
Electric Fish as a Tool for Water Quality Assessment,
W80-00659 5A

CITY OF LONDON POLYTECHNIC (ENGLAND). DEPT. OF BIOLOGICAL SCIENCES.
A Seasonal Survey of Fish Populations in the Lower Medway Estuary, Kent, Based on Power Station Screen Samples,
W80-00650 5C

COASTAL ENGINEERING RESEARCH CENTER, FORT BELVOIR, VA.
Sand Bed Friction Factors for Oscillatory Flows,
W80-00734 2L

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
Persistence of Chlorine in Cooling Water from Electric Generating Station,
W80-00581 5A

Geomorphic Study of Upper Mississippi River,
W80-00585 2E

Irrigation Technology for Desert Land Reclamation,
W80-00641 3F

Use of Water Quality Variables for Estimation of Water Quantity Characteristics,
W80-00709 2A

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF FISHERY AND WILDLIFE BIOLOGY.
Carbonic Acid Anesthesia for Aquatic Organisms,
W80-00786 5A

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF POLITICAL SCIENCES.
Water USA: 1776-1976,
W80-00486 6E

COLORADO STATE UNIV., FORT COLLINS. ENGINEERING RESEARCH CENTER.
Effects of In-Transit Water on Groundwater Mounds Beneath Circular and Rectangular Recharge Areas,
W80-00610 2F

COLORADO UNIV., BOULDER. DEPT. OF ECONOMICS.
The Design and Evaluation of Institutional Arrangements for Water Planning and Management,
W80-00431 6E

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF PLANT INDUSTRY.
Rainfall Interception by Eight Small Trees,
W80-00744 2I

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA CITY (AUSTRALIA). DIV. OF ENVIRONMENTAL MECHANICS.
Absorption of Water by Soil: The Constant Flux Boundary Condition,
W80-00596 2G

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, WEMBLEY (AUSTRALIA). DIV. OF LAND RESOURCES MANAGEMENT.
Evaporation from Vegetation in Landscapes Developing Secondary Salinity Using the Ventilated-Chamber Technique, I. Comparative Transpiration from Juvenile Eucalyptus Above Saline Groundwater Seeps,
W80-00755 2I

COMPTROLLER GENERAL OF THE UNITED STATES, WASHINGTON, DC.
Water Supply for Urban Areas: Problems in Meeting Future Demand,
W80-00543 6D

Colorado River Basin Water Problems: How to Reduce Their Impact,
W80-00545 6E

Ways to Resolve Critical Water Resources Issues Facing the Nation,
W80-00546 6E

CONNECTICUT UNIV., STORRS. INST. OF WATER RESOURCES.
Potential Ground Water Pollution from Sewage Sludge Application on Agricultural Land,
W80-00489 5G

CONSTRUCTION ENGINEERING RESEARCH LAB. (ARMY), CHAMPAIGN, IL.
Water Usage Profile-Fort Carson Co.,
W80-00494 6D

CORNELL UNIV., ITHACA, NY. PROGRAM IN URBAN AND REGIONAL STUDIES.
Implementation Strategies for Public Law 92-500, Section 208,
W80-00524 6E

Urban Stormwater Pollution: An Investigation of the Problem and Its Control,
W80-00525 5B

Integration of Residual Waste Management with Water Quality Management,
W80-00526 6E

Integrated Planning and Water Quality Management: The Federal Water Pollution Control Act Amendments of 1972 and Coastal Zone Management,
W80-00527 6E

CORNELL UNIV., ITHACA, NY. SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Cooling Impoundments: Classification and Analysis,
W80-00580 2H

CORPORATION FOR ENGINEERING, GEOLOGICAL AND HYDROLOGICAL INVESTIGATION, PRAGUE (CZECHOSLOVAKIA). STAVEBNI GEOLOGIE.
Hydrological and Geochemical Mass Balance in Small Forested and Agricultural Basins,
W80-00703 2A

CULP/WESNER/CULP, EL DORADO HILLS, CA.
Environmental Pollution Control Alternatives: Municipal Wastewater,
W80-00544 5D

DAMES AND MOORE WATER POLLUTION CONTROL ENGINEERING SERVICES, DENVER, CO.
Analysis of Operations and Maintenance Costs for Municipal Wastewater Treatment Systems,
W80-00549 6B

DEARBORN CHEMICAL CO. LTD., OTTAWA (ONTARIO). DEARBORN ENVIRONMENTAL CONSULTING SERVICES.
The Use of the ATP Assay for Rapid Assessment of Water Quality,
W80-00552 5A

DELAWARE UNIV., LEWES. MARINE STUDIES COMPLEX.
Summertime Synoptic Variability of the Middle Atlantic Shelf Water/Slope Water Front,
W80-00740 2L

DEPARTMENT OF AGRICULTURE, SWIFT CURRENT (SASKATCHEWAN). RESEARCH STATION.
Predicting Hysteretic Effects in Evaporation From Bare Soil,
W80-00732 2D

DEPARTMENT OF FISHERIES AND ENVIRONMENT, BURLINGTON (ONTARIO).
Sources, Transportation and Utilization of Dissolved Organic Matter in Groundwater and Streams,
W80-00530 2F

DEPARTMENT OF HEALTH, PRETORIA (SOUTH AFRICA).
Microbiological Water Quality in Relation to Public Health,
W80-00482 3C

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, WASHINGTON, DC.
The United States Experience in Flood Plain Management,
W80-00459 6F

DEPARTMENT OF PUBLIC WORKS, BANGKOK (THAILAND). RURAL WATER SUPPLY DIV.
Water for Domestic Use in Rural Areas - Thailand,
W80-00448 6D

DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO). INLAND WATERS DIRECTORATE.
Boundary Waters Management,
W80-00480 6E

DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO). WATER PLANNING AND MANAGEMENT BRANCH.
River Basin Planning in Canada,
W80-00472 6A

DEPARTMENT OF THE ENVIRONMENT, READING (ENGLAND). CENTRAL WATER PLANNING UNIT.
River Basin Management in the United Kingdom.
W80-00449 6A

DEPARTMENT OF THE ENVIRONMENT, VANCOUVER (BRITISH COLUMBIA). INLAND WATER DIRECTORATE.
Importance of Lake-River Interaction on Seasonal Patterns in the General Circulation of Kamloops Lake, British Columbia,
W80-00631 2H

DEPARTMENT OF TRANSPORTATION, WASHINGTON, DC.
U.S. Inland Water Transportation,
W80-00473 6E

DEPARTMENT OF WATER AFFAIRS, PRETORIA (SOUTH AFRICA),
Inter Basin Water Transfers in South Africa,
W80-00483 6D

DEUTSCHE AKADEMIE DER WISSENCHAFTEN ZU BERLIN (GERMAN D.R.). INST. FUER GEOGRAPHIE AND GEOOKOLOGIE.
A Mathematical Ecosystem Model Applicable to Shallow Water Bodies,
W80-00711 2L

DEUTSCHE AKADEMIE DER WISSENSCHAFTEN ZU BERLIN (GERMAN D.R.). INST. FUER GEOGRAPHIE AND GEOOKOLOGIE.
On the Theoretical Basis of Modelling the Quality of Surface and Subsurface Waters,
W80-00700 5B

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC (UN), BANGKOK (THAILAND).
Report of the ESCAP Regional Preparatory Meeting for the United Nations Water Conference.
W80-00406 6A

ECONOMIC COMMISSION FOR AFRICA (UN), ADDIS ABABA (ETHIOPIA).
Economic Commission for Africa, Regional Report,
W80-00409 6A

ECONOMIC COMMISSION FOR EUROPE (UN), GENEVA (SWITZERLAND).
Economic Commission for Europe. Regional Report,
W80-00408 6A

Long-Term Planning of Water Management,
W80-00434 6A

Rational Methods of Flood Control Planning in River Basin Development,
W80-00435 6A

Principles and Methods for the Provision of Economic Incentives in Water Supply and Waste Water Disposal Systems.
W80-00436 6B

ECONOMIC COMMISSION FOR EUROPE (UN), GENEVA (SWITZERLAND). COMMITTEE ON WATER PROBLEMS.
CMEA Glossary on Water Management,
W80-00437 6A

ECONOMIC COMMISSION FOR LATIN AMERICA (UN), MEXICO CITY.
Report of the Regional Preparatory Meeting of the Countries of Latin America and the Caribbean for the United Nations Water Conference,
W80-00407 6A

ECONOMIC COMMISSION FOR LATIN AMERICA (UN), NEW YORK.
The Water Resources of Latin America Regional Report,
W80-00415 6A

ECONOMIC COMMISSION FOR WESTERN ASIA (UN), BEIRUT (LEBANON).
Report of the Economic Commission for Western Asia Regional Preparatory Meeting.
W80-00410 6A

EGYPTIAN DESERT INST., CAIRO.
Application of Geoscientific Knowledge to Evaluation of Land and Water Resources in Some Desert Areas of Egypt,
W80-00639 6B

ELECTRICITE DE FRANCE, CHATOU. DIRECTION DES ETUDES ET RECHERCHES.
Effects of the Construction of a Broad Waterway on the Water Quality of the Doubs (Effets de la Canalisation a Grand Gabarit sur la Qualite des Eaux du Doubs),
W80-00704 5B

ENVIRO CONTROL, INC., FORT COLLINS, CO.
Instream Flow Strategies for Washington,
W80-00531 6E

Instream Flow Strategies for California,
W80-00532 6E

ENVIRONMENTAL HEALTH DIRECTORATE, OTTAWA (ONTARIO). BUREAU OF CHEMICAL HAZARDS.
A Comparison of Dynamic and Static Head Space and Solvent Extraction Techniques for the Determination of Trihalomethanes in Water,
W80-00617 5A

ENVIRONMENTAL POLLUTION CONTROL PROJECT, ATHENS (GREECE).
The Effects of Pollution-Induced Oxygen Deficiency on the Benthos in Elefsis Bay, Greece,
W80-00690 5C

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC.
Toxic Substances in Water--The U.S. Experience.
W80-00456 5G

ENVIRONMENTAL RESEARCH LAB.-DULUTH, MN.
Temperature-Monitoring and Safety-Control Device,
W80-00783 5A

ENVIROSPHERE CO. INC., NEW YORK.
Source Schematization Effects on Farfield Results,
W80-00723 2H

FEDERAL ENERGY REGULATORY COMMISSION, WASHINGTON, DC. OFFICE OF ELECTRIC POWER REGULATION.
Planning Status Report, Water Resources Appraisals for Hydroelectric Licensing: Lower Arkansas River Basin-Arkansas, Colorado, Kansas, New Mexico, Oklahoma and Texas,
W80-00533 6D

FISH AND WILDLIFE SERVICE, BOZEMAN MT. FISH CULTURAL DEVELOPMENT.
Hepatomas in Atlantic Tomcod Microgadus Tomcod (Walbaum) Collected in the Hudson River Estuary in New York,
W80-00675 5B

FISH AND WILDLIFE SERVICE, JENA, LA. CATAHOULA NATIONAL WILDLIFE REFUGE.
Lead and Mercury in Lesser Snow Geese Wintering in Louisiana,
W80-00799 5A

FISH AND WILDLIFE SERVICE, KEARNEYVILLE, WV. WATER RESOURCES ANALYSIS.
Impact Assessment of Water Resource Development Activities: A Dual Matrix Approach,
W80-00550 6B

FISH AND WILDLIFE SERVICE, WARM SPRINGS, GA. SOUTHEASTERN FISH CONTROL.
Toxicity of Fishery Chemicals to the Asiatic Clam, Corbicula Manilensis,
W80-00785 5A

FISHERIES AND MARINE SERVICE, WINNIPEG (MANITOBA). FRESHWATER INST.
The Source of Muddy Odor in Bream (Abramis Brama) from the Porvoo Sea Area (Gulf of Finland),
W80-00661 5A

Oxygen Depletion and Winterkill Risk in Small Prairie Lakes Under Extended Ice Cover,
W80-00668 5A

FISHERIES RESEARCH STATION, ABERDEEN (HONG KONG).

FISHERIES RESEARCH STATION, ABERDEEN (HONG KONG).
The Rock Oyster Saccostrea Glomerata as an Indicator of Trace Metals in Hong Kong,
W80-00793 5A

FLEET WEATHER FACILITY, SUITLAND, MD.
Data Sources and Sea Ice Products of Fleet Weather Facility/Joint Ice Center, Suitland,
W80-00568 2C

FLORIDA UNIV., GAINESVILLE. DEPT. OF ENVIRONMENTAL ENGINEERING SCINECES.
Transport of Viruses Through Organic Soils and Sediments,
W80-00584 5E

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, ROME (ITALY).
Water for Agriculture.
W80-00424 4A

FOREST RESEARCH INST. CHRISTCHURCH (NEW ZEALAND).
Streamflow Generation in a Forested Watershed, New Zealand,
W80-00724 2E

GATES (W. E.) AND ASSOCIATES, CINCINNATI, OH.
Engineering and Cost Parameters,
W80-00564 6B

GENERAL ACCOUNTING OFFICE, WASHINGTON, DC.
Water Resources and the Nation's Water Supply: Issues and Concerns,
W80-00542 6B

GENERAL CO. FOR RESEARCH AND GROUNDWATER, CAIRO (EGYPT).
Water Resources and Land Reclamation in Egypt,
W80-00643 6B

GENOA UNIV. (ITALY). INST. OF HYGIENE.
Survey of the Pollution in a Coastal Area of the Tyrrhenian Sea. Aerial Photography, Physico-Chemical and Microbiological Investigations and Mutagenic Monitoring,
W80-00796 5A

GEOLOGICAL SURVEY, ALBANY, NY. WATER RESOURCES DIV.
Ground-Water Appraisal for the Community of Kiryas Joel, Orange County, New York,
W80-00759 2A

Ground Water in Dale Valley, New York,
W80-00768 4B

Recharge to Low-Level Radioactive-Waste Burial Trenches 11 Through 14, West Valley, New York,
W80-00775 5E

GEOLOGICAL SURVEY, ALBUQUERQUE, NM. WATER RESOURCES DIV.
Annual Water-Resources Review, White Sands Missile Range, New Mexico, 1978,
W80-00764 4D

GEOLOGICAL SURVEY, CARSON CITY, NV. WATER RESOURCES DIV.
Water-Resources Investigations in Nevada, 1978.
W80-00776 7A

GEOLOGICAL SURVEY, CHAMPAIGN, IL. WATER RESOURCES DIV.
Effects of Urbanization on the Magnitude and Frequency of Floods in Northeastern Illinois,
W80-00769 4C

GEOLOGICAL SURVEY, CHARLESTON, WV. WATER RESOURCES DIV.
Drainage Areas of the Twelvepole Creek Basin, West Virginia, Big Sandy River Basin, West Virginia, Tug Fork Basin, Virginia, Kentucky, West Virginia,
W80-00765 7C

GEOLOGICAL SURVEY, COLUMBIA, SC. WATER RESOURCES DIV.
Water Resources Data for South Carolina, Water Year 1978.
W80-00778 7C

GEOLOGICAL SURVEY, DORAVILLE, GA. WATER RESOURCES DIV.
A Preliminary Appraisal of the Impact of Agriculture on Ground-Water Availability in Southwest Georgia,
W80-00770 4B

GEOLOGICAL SURVEY, HONOLULU, HI. WATER RESOURCES DIV.
Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 1. Hawaii.
W80-00779 7C

Water Resources Data for Hawaii and Other Pacific Areas, Water Year 1978--Volume 2. Trust Territory of the Pacific Islands, Guam, American Samoa, and Northern Mariana Islands,
W80-00780 7C

GEOLOGICAL SURVEY, LAWRENCE, KS. WATER RESOURCES DIV.
Determination of Peak Discharge from Rainfall Data for Urbanized Basins, Wichita, Kansas,
W80-00774 6A

GEOLOGICAL SURVEY, LOUISVILLE, KY. WATER RESOURCES DIV.
Floods of December 1978 in Kentucky,
W80-00758 2E

GEOLOGICAL SURVEY, MADISON, WI. WATER RESOURCES DIV.
Contamination Potential in the Silurian Dolomite Aquifer, Eastern Wisconsin,
W80-00757 5B

Water Resources Data for Wisconsin, Water Year 1978.
W80-00777 7C

GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.
Digital Model of the Hollister Valley Ground-Water Basin, San Benito County, California,
W80-00756 6A

Ground-Water Conditions and Potential for Artificial Recharge in Lucerne Valley, San Bernardino County, California,
W80-00763 4B

GEOLOGICAL SURVEY, NSTL STATION, MS. WATER RESOURCES DIV.
Estimating the Gas and Dye Quantities for Modified Tracer Technique Measurements of Stream Reaeration Coefficients,
W80-00773 5B

GEOLOGICAL SURVEY OF ALABAMA, MONTGOMERY.
Ground-Water Management Techniques for the Control of Salt-Water Encroachment in Gulf-Coast Aquifers, A Summary Report,
W80-00490 2F

GEOLOGICAL SURVEY OF AUSTRALIA, MELBOURNE. DEPT. OF MINERALS AND ENERGY.
A Method of Aquifer Testing and Its Application to an Anisotropic Inhomogeneous Multiple Aquifer System,
W80-00727 2F

GEOLOGICAL SURVEY, RESTON, VA.
Current Methodologies for the Collection and Dissemination of Water Resources Data in the United States,
W80-00474 7A

GEOLOGICAL SURVEY, ROLLA, MO. WATER RESOURCES DIV.
Technique for Estimating the Magnitude and Frequency of Floods in St. Louis County, Missouri,
W80-00762 2E

GEOLOGICAL SURVEY, TACOMA, WA. WATER RESOURCES DIV.
Flood Profiles Along the Cedar River, King County, Washington,
W80-00760 2E

Comparison of Selected Cultural, Physical, and Water-Quality Characteristics of Lakes in Washington,
W80-00766 2H

GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.
Evaluation of a Digital Model for Estuarine Water Quality Simulation in Waste Allocation Studies,
W80-00761 5B

Water-Quality Assessment of Runoff from a Rural Highway Bridge Near Tallahassee, Florida,
W80-00767 5B

Stormwater-Runoff Data for a Commercial Area, Broward County, Florida,
W80-00772 4C

GEOLOGICAL SURVEY, TUCSON, AZ. WATER RESOURCES DIV.
Statistical Summaries of Arizona Streamflow Data,
W80-00771 2E

GEOLOGICAL SURVEY, WASHINGTON, DC.
Remote Sensing for Water Resources Management.
W80-00475 7B

GEZIRA AGRICULTURAL RESEARCH STATION, WAD MEDANI (SUDAN).
A Modified Permeameter for Measuring Hydraulic Conductivity of Soils,
W80-00614 2G

GHENT RIJKSUNIVERSITEIT (BELGIUM). LAB. FOR BIOLOGICAL RESEARCH IN ENVIRONMENTAL POLLUTION.
The Biochemical Composition of the Larvae of Two Strains of Artemia Salina (L.) Reared on two Different Algal Foods,
W80-00502 5C

GROUPEMENT D'ETUDES ET DE REALISATIONS DES SOCIETES D'AMENAGEMENT REGIONAL, NIMES (FRANCE).
Simulation Model of the Evolution of the Chemical Composition of a Mineral-Solution System and its Applications (Modele de Simulation de L'Evolution de la Composition Chimique d'un Systeme Mineraux-Solution et ses Applications),
W80-00721 5A

GUELPH UNIV. (ONTARIO). DEPT. OF ZOOLOGY.
Chronic Toxicity of Vanadium to Flagfish,
W80-00795 5A

HASKONING, NIJMEGEN (NETHERLANDS).
Energy Exchange Between Deep Lakes and the Atmosphere and the Consequences for the Wind-Mixed Layer Dynamics,
W80-00713 2L

HAWAII UNIV., HONOLULU. SEA GRANT COLL. PROGRAM.
Algal Biochemical Tricks and Classification,
W80-00512 5C

HILL AND BARLOW, BOSTON, MA.
Federal Tax Incentives for Private Environmental Planning,
W80-00496 6E

HOHENHEIM UNIV., STUTTGART (GERMANY, F.R.). INST. FOR PHYTOMEDICINE.
Efficacy, Uptake and Distribution of Different Herbicides in the Water Hyacinth,
W80-00519 5C

HOLY SEE, VATICAN CITY (ITALY).
The World's Water in a Human Perspective.
W80-00453 6A

IBM SCIENTIFIC CENTER, HAIFA (ISRAEL).
Optimal Management of a Multireservoir Water Supply System,
W80-00583 4A

ILLINOIS INST. OF TECH., CHICAGO. PRITZKER DEPT. OF ENVIRONMENTAL ENGINEERING.
Environmental Observations of a Riparian Ecosystem During Flood Season,
W80-00691 2E

ILLINOIS STATE WATER SURVEY PEORIA.
Phytoplankton in the Fox Chain of Lakes,
W80-00686 5C

ILLINOIS STATE WATER SURVEY, URBANA.
Water Withdrawals in Illinois, 1978,
W80-00722 7C

INSTITUTE OF CIVIL AND CONSTRUCTION ENGINEERING, SPLIT (YUGOSLAVIA). FACULTY OF CIVIL ENGINEERING.
Influence of Turbulence on the Accuracy of Discharge Measurements in Natural Streamflows,
W80-00745 2E

INSTITUTE OF METEOROLOGY AND WATER MANAGEMENT, WARSAW (POLAND).
Mass Transfer Models of Sorption and Desorption of Radionuclides by Aquatic Plants,
W80-00705 2A

Heat and Mass Exchange Coefficients for Open Water Surfaces,
W80-00714 2D

INSTITUTE OF WATER ECONOMICS, LAW, AND ADMINISTRATION (ARGENTINA).
Economic Parameters,
W80-00563 6B

INSTITUTO DE INVESTIGACIONES PESQUERAS, VIGO (SPAIN).
Structure and Succession in Rocky Algal Communities of a Temperate Intertidal System,
W80-00504 5C

INSTYTUT RYBACTWA SRODLADOWEGO, ZABIENIEC (POLAND). DEPT. OF FISH CULTURE.
The Influence of Fertilization on Phytoplankton in Ponds with Varied Development of Biocoenose,
W80-00509 5C

INTERMEDIATE TECHNOLOGY DEVELOPMENT GROUP, LONDON (ENGLAND).
Water for the Thousand Millions,
W80-00432 6A

INTERNATIONAL ASSOCIATION FOR WATER LAW.
Water Law and Legislation: How to use them to Obtain Optimum Results from Water Resources,
W80-00428 6E

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA (AUSTRIA).
Isotope Hydrology.
W80-00421 4A

INTERNATIONAL INST. FOR APPLIED SYSTEMS ANALYSIS, LAXENBURG (AUSTRIA).
A Dynamic Model of the Chemical Nutrient System for Research of the Ecological Consequences in Natural Water,
W80-00701 5B

INTERNATIONAL LAB. OF MARINE RADIOACTIVITY, MONTE CARLO (MONACO). OCEANOGRAPHIC MUSEUM.
Body Burden of Chromium, Copper, Cadmium and Lead in the Neustonic Copepod Anomalocera Patersoni (Pontellidae) Collected from the Mediterranean Sea,
W80-00665 5A

IOWA STATE UNIV., AMES. DEPT. OF AGRONOMY.
Casing and Leak Depths, and Solute Travel Times to Wells,
W80-00579 5B

Microbial Effects on Soil Erodibility,
W80-00594 2J

A Galerkin in Time, Linearized Finite Element Model of 2-Dimensional Unsaturated Porous Media Drainage,
W80-00753 2G

ISRAEL STATE WATER COMMISSION.
Non Conventional Water Resources: Some Advances in their Development,
W80-00429 3C

JAMES COOK UNIV. OF NORTH QUEENSLAND, TOWNSVILLE (AUSTRALIA). DEPT. OF GEOGRAPHY.
A Statistical Method for Modelling the Fate of Rainfall in a Tropical Rainforest Catchment,
W80-00748 2E

JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF GEOGRAPHY AND ENVIRONMENTAL ENGINEERING.
The Mathematical Programming Screening Model,
W80-00559 6A

The Mathematical Programming Sequencing Model,
W80-00562 6A

Outputs of the Models,
W80-00565 6A

KANSAS UNIV., LAWRENCE. DEPT. OF BOTANY.
Phytoplankton Succession in Nutrient Enriched Experimental Ponds As Related to Changing Carbon, Nitrogen, and Phosphorus Conditions,
W80-00517 5C

KENTUCKY AGRICULTURAL EXPERIMENT STATION, LEXINGTON. DEPT. OF AGRONOMY.
Soil Water in Coarse Fragments,
W80-00592 2G

KING ABDULAZIZ UNIV., JEDDAH (SAUDI ARABIA).
Development of Water Resources and its Influence on the Ecology of Saudi Arabia,
W80-00640 6G

KING'S COLL., LONDON (ENGLAND). DEPT. OF CIVIL ENGINEERING.
A Finite-Element Distributed Catchment Model, II. Application to Real Catchments,
W80-00749 2E

KYUSHU UNIV., FUKUOKA (JAPAN). DEPT. OF FISHERIES.
Effects of Oral Administration of Cadmium on Fish-V Effects on Calcium and Inorganic Phosphorus Excretion in the Carp,
W80-00663 5A

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, NY.
Accuracy of Snow and Ice Monitoring,
W80-00575 2C

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, NY. DEPT. OF MARINE BIOLOGY.
The Production and Fate of Phytoplankton Size Fractions in the Plume of the Hudson River, New York Bight,
W80-00628 2L

LANDESANSTALT FUER UMWELTSCHUTZ BADEN-WURTTENBERG, KARLSRUHE (GERMANY, F.R.).
The Biocenotic Model,
W80-00707 5B

LINCOLN COLL. (NEW ZEALAND). DEPT. OF AGRICULTURAL ENGINEERING.
Ground Water Replenishment from Riverflow,
W80-00604 2F

LOUVAIN UNIV. (BELGIUM). DEPT. OF GENIE RURAL.
Physical Components of the Diffusivity Coefficient,
W80-00754 2G

MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM, PLYMOUTH (ENGLAND). PLYMOUTH LAB.
Effects of Kuwait Oils on Feeding Rates of Copepods,
W80-00666 5A

MARYLAND UNIV., COLLEGE PARK.
Detailed Structure of pH in Hydrometeors,
W80-00616 2K

MARYLAND UNIV., COLLEGE PARK. DEPT. OF CIVIL ENGINEERING.
Statistical Terminology: Definitions and Interpretation for Flood Peak Estimation,
W80-00729 2E

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF CIVIL ENGINEERING.
Planning Theory: Multiobjectives,
W80-00556 6A

Planning Theory: The Role of Mathematical Models in Water Resources Planning,
W80-00557 6A

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. RALPH M. PARSONS LAB. FOR WATER RESOURCES AND HYDRODYNAMICS.
Modelling of the Eutrophication Process in Lakes and Reservoirs,
W80-00718 2H

MCMASTER UNIV., HAMILTON (ONTARIO). DEPT. OF GEOLOGY.
Measurement of Complexing Materials Excreted from Algae and Their Ability to Ameliorate Copper Toxicity,
W80-00667 5A

MELBOURNE UNIV. MEDICAL CENTRE. PARKVILLE (AUSTRALIA).

MELBOURNE UNIV. MEDICAL CENTRE. PARKVILLE (AUSTRALIA).
Survey of Demersal Fish in Port Phillip Bay for Incidence of Neoplasia,
W80-00680 5A

MELBOURNE UNIV., PARKSVILLE (AUSTRALIA).
Inter-State Rivers in Australia,
W80-00461 6E

MEMBRANE SYSTEMS, INC., SAN DIEGO, CA.
Development of a Chlorine Resistant Reverse Osmosis Membrane and Porous Membrane Supports,
W80-00487 3A

MICHIGAN UNIV., ANN ARBOR. GREAT LAKES RESEARCH DIV.
A Morphometric Study of Lead and Copper Effects on Diatoma Tenue Var. Elongatum (Bacillariophyta),
W80-00782 5A

MINISTRY OF AGRICULTURE, TEL-AVIV (ISRAEL).
Israel- A Model of Efficient Utilization of a Country's Water Resources,
W80-00471 6E

MINISTRY OF AGRICULTURE, WARSAW (POLAND).
Water Law and Its Application in Poland,
W80-00443 6E

MINISTRY OF AGRUCULTURE, CRUMLIN (NORTHERN IRELAND). FRESHWATER BIOLOGICAL INVESTIGATION UNIT.
Evaluation of an Enzymatic Method for Orthophosphate Determination in Freshwaters,
W80-00625 5A

MINISTRY OF INTERNATIONAL TRADE AND INDUSTRY, TOKYO (JAPAN).
The Industrial Water Service of Japan,
W80-00476 6E

On Water Reuse Promotion Measures,
W80-00477 6F

MISSISSIPPI STATE UNIV., MISSISSIPPI STATE.
The Effects of Channelization on Furbearers and Furbearer Habitat,
W80-00800 5C

MISSOURI UNIV.-COLUMBIA, PUXICO. GAYLORD MEMORIAL LAB.
Floral and Faunal Changes in Lowland Hardwood Forests in Missouri Resulting from Channelization, Drainage, and Impoundment,
W80-00528 6G

MITRE CORP., MCLEAN, VA.
Silver Concentration in Rainwater from Seeded and Nonseeded Florida Cumuli: 1973-1975 Results,
W80-00736 2B

MONTANA STATE UNIV., BOZEMAN. INST. OF APPLIED RESEARCH.
Impacts of a Large Recreational Development on Water Quality in a Semi-Primitive Environment,
W80-00498 5C

MOSUL UNIV. (IRAQ). COLL. OF ENGINEERING.
A Water Quality Study of a Stretch of the River Tigris,
W80-00623 5A

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
NASA Mapping Projects (Summary),
W80-00578 7C

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH, BOULDER, CO.
Snow and Ice Data Sets for Climate and Water Resource Studies with Particular Reference to North America,
W80-00567 2C

NATIONAL CLIMATIC CENTER, ASHEVILLE, NC.
The United States Environmental Satellite Data Archives,
W80-00571 7B

NATIONAL COMMITTEE FOR THE INTERNATIONAL HYDROLOGICAL PROGRAMME (USSR).
World Water Balance and Water Resources of the Earth,
W80-00466 2A

NATIONAL ENVIRONMENTAL SATELLITE SERVICE. WASHINGTON, DC.
Satellite-Derived River Basin Snow-Cover Percentages: A New Data Base for Hydrologists,
W80-00572 7B

NATIONAL INST. OF OCEANOGRAPHY, GOA (INDIA).
Some Observations on Pollutants of Velsao Bay (GOA),
W80-00688 5A

NATIONAL MARINE FISHERIES SERVICE, AUKE BAY, AK. AUKE BAY LAB.
Sensitivity of Alaskan Freshwater and Anadromous Fishes to Prudhoe Bay Crude Oil and Benzene,
W80-00660 5A

NATIONAL MARINE FISHERIES SERVICE, BEAUFORT, NC.
Distribution of Suspended Bacteria in Neritic Waters South of Long Island During Stratified Conditions,
W80-00627 2L

NATIONAL MARINE FISHERIES SERVICE, GALVESTON, TX. SOUTHEAST FISHERIES CENTER.
Environmental Assessment of an Active Oil Field in the Northwestern Gulf of Mexico 1977-1978. Volume III: Chemical and Physical Investigations.
W80-00692 5C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, BOULDER, CO. ENVIRONMENTAL RESEARCH LABS.
Chemical Pollutants of the New York Bight; Priorities for Research,
W80-00697 5C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMI, FL. ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABS.
Polychlorinated Biphenyls and Chlorinated Pesticides in Soils of the Everglades National Park and Adjacent Agricultural Areas,
W80-00618 5A

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, WASHINGTON, DC. OFFICE OF COASTAL ZONE MANAGEMENT.
Coastal Zone Management In The United States,
W80-00478 6E

NATIONAL SWEDISH ENVIRONMENT PROTECTION BOARD, STOCKHOLM.
Swedish Policy for Water Quality Protection,
W80-00454 6E

NATIONAL WATER BOARD OF FINLAND, HELSINKI.
Finnish Experiences in Water-Resources Planning and Management Policy,
W80-00451 6A

Adaptation of the EPAECO Model to a Lake in Central Finland,
W80-00710 2L

NATIONAL WEATHER SERVICE, SILVER SPRING, MD. OFFICE OF HYDROLOGY.
Precipitable Water Over the United States. Volume II: Semimonthly Maxima,
W80-00698 2B

NATURHISTORISKA RIKSMUSEET, STOCKHOLM (SWEDEN). SECTION FOR INVERTEBRATE ZOOLOGY.
A History of Mercury Levels in Swedish Fauna,
W80-00649 5A

NAVAL POSTGRADUATE SCHOOL, MONTEREY, CA. DEPT. OF OCEANOGRAPHY.
Energetics of Breaking Waves Within the Surf Zone,
W80-00737 2L

NEBRASKA UNIV., LINCOLN, INST. OF AGRICULTURAL AND NATURAL RESOURCES.
Chemical Seepage from a Tail Water Recovery Pit to Adjacent Ground Water,
W80-00621 5B

NEVADA UNIV. SYSTEM, RENO. DESERT RESEARCH INST.
Physiological Adaptations of Salmonid Fishes (Salmo clarki henshawi, Salmo gairdneri, and Oncorhynchus kisutch) to Alkaline Saline Water and Their Toxic Effects,
W80-00488 2H

NEW JERSEY INST. OF TECH., NEWARK. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Time Series Analysis of Ammonia in the Passaic River,
W80-00638 5C

NEW MEXICO UNIV., ALBUQUERQUE.
Appropriative Water Rights and Efficient Allocation of Resources,
W80-00548 6E

NEW ORLEANS UNIV., LA. URBAN STUDIES INST.
Guidelines for Urban Development in Louisiana's Coastal Wetlands,
W80-00547 4C

NEW YORK STATE DEPT. OF CONSERVATION, ALBANY, OFFICE OF ENVIRONMENTAL ANALYSIS.
Application of the Aquatic Model Cleaner to a Stratified Reservoir System,
W80-00520 5C

NILE WATERS DEPT., KHARTOUM (SUDAN).
The Projects for the Increase of the Nile Yield with Special Reference to Jonglei Project,
W80-00447 4A

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF ECONOMICS AND BUSINESS.
An Analysis of Residential Demand for Water Using Micro Time-Series Data,
W80-00599 6D

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF ZOOLOGY.
Thermal Shock Resistance of Spot (Leiostomus Xanthurus) After Acclimation to Constant or Cycling Temperature,
W80-00652 5C

NORTH CAROLINA UNIV. AT CHAPEL HILL. DEPT. OF GEOLOGY.
Foraminifera in Brackish-Water Ponds Designed for Waste Control and Aquaculture Studies in North Carolina,
W80-00523 5C

OAK RIDGE NATIONAL LAB., TN.
Modified Venture Suction Sampler for Collecting Asiatic Clams,
W80-00787 5A

OFFICE DE LA RECHERCHE SCIENTIFIQUE ET TECHNIQUE OUTRE-MER, ABIDJAN (IVORY COAST). CENTRE DE RECHERCHES OCEANOGRAPHIQUES.
The Use of the Salinity Maximum of the Equatorial Undercurrent for Estimating Nutrient Enrichment and Primary Production in the Gulf of Guinea,
W80-00781 5C

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF GEOTECHNICAL ENGINEERING.
Best Ways to Dewater Dredged Material,
W80-00733 2G

OKLAHOMA STATE UNIV., STILLWATER. SCHOOL OF CIVIL ENGINEERING.
The Effects of pH on the Aluminum, Iron and Calcium Phosphate Fractions of Lake Sediments,
W80-00588 2J

OSLO UNIV. (NORWAY). INST. FOR MARINE BIOLOGY.
The Temperature Preference of the Three-Spined Stickleback, Gasterosteus Aculeatus L. (Pisces), Collected at Different Seasons,
W80-00797 5A

OTAGO UNIV., DUNEDIN (NEW ZEALAND). DEPT. OF GEOGRAPHY.
Note on the Distribution of Flood Maxima for Random Sample Size,
W80-00611 2E

OVERSEAS DEVELOPMENT INST., LONDON (ENGLAND).
Irrigation Management in Developing Countries: A Suggested Action Programme,
W80-00481 3F

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION, CORVALLIS, OR. FORESTRY SCIENCES LAB.
The Response of Coho Salmon and Guppies to 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) in Water,
W80-00651 5A

POHJOS-SUOMEN VESITUTKIMUSTOIMISTO, OULU (FINLAND).
Phytoplankton in the Coastal Waters of the Bothnian Bay Off Kemi,
W80-00518 5C

POLISH ACADEMY OF SCIENCES, WARSAW. DEPT. OF ECOLOGICAL BIOENERGETICS.
Experimental and Field Studies on Ecological Energetics of Asellus Aquaticus L. (Isopoda). Energy Budget of a Population in the Littoral Zone of Powsinskie Lake,
W80-00507 5C

PROCTER AND GAMBLE CO., CINCINNATI, OH.
Reduction of Nonionic Surfactant Toxicity by Secondary Treatment,
W80-00678 5A

PUBLIC SERVICE ELECTRIC AND GAS CO., NEWARK, NJ. RESEARCH AND DEVELOPMENT DEPT.
Integration of Thermal and Food Processing Residuals into a System for Commercial Culture of Freshwater Shrimp. (Power Plant Waste Heat Utilization in Aquaculture)., Volume II,
W80-00497 3C

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF AGRONOMY.
Nature and Properties of Water in Montmorillonite-Water Systems,
W80-00597 2G

PURDUE UNIV., LAFAYETTE, IN. WATER RESOURCES RESEARCH CENTER.
Socio-Economic Relationships for Water-Based Recreation Involvement in Indiana,
W80-00636 6B

The Importance of Tributary Streams to the Reproduction of Catostomios and Sauger,
W80-00637 6G

QUEEN MARY COLL., LONDON (ENGLAND). DEPT. OF ZOOLOGY AND COMPARATIVE PHYSIOLOGY.
The Effect of Cadmium and Lead on the Growth of Two Species of Marine Phytoplankton with Particular Reference to the Development of Tolerance,
W80-00676 5A

RANDSE AFRIKAANSE UNIV., JOHANNESBURG (SOUTH AFRICA). DEPT. OF ZOOLOGY.
Comparison of Anesthetic Potency of Benzocaine Hydrochloride and MS-222 in Two Freshwater Fish Species,
W80-00784 5A

READING UNIV. (ENGLAND). DEPT. OF SOIL SCIENCE.
Use of Fluorescent Dyes to Mark the Pathways of Solute Movement Through Soils Under Leaching Conditions: 2. Field Experiments,
W80-00615 2G

RENSSELAER POLYTECHNIC INST., TROY, NY. CENTER FOR ECOLOGICAL MODELING.
A Model for Simulating Lake Ecosystems,
W80-00521 5C

Mathematical Modeling of Phytoplankton Kinetics with Application to Two Alpine Lakes,
W80-00522 5C

RESEARCH CORPORATION OF THE UNIVERSITY OF HAWAII, HONOLULU.
Responses of Marine Fouling Communities to Sewage Abatement in Kaneohe Bay, Oahu, Hawaii,
W80-00791 5B

RESEARCH INST. FOR WATER RESOURCES DEVELOPMENT, BUDAPEST (HUNGARY).
Methods for Estimating Ground Water Resources and the Balance of Subsurface Waters,
W80-00440 6B

Environmental Aspects of Pollution Control in Hungary,
W80-00441 6A

Restriction of Supply and Risk in Water Supply Systems,
W80-00442 6C

An Effort for Modelling the Transport of Micropollutants in Rivers,
W80-00702 5B

The Use and Limitations of a Two-Dimensional Mixing Model for Rivers,
W80-00708 5B

A Simple Eutrophication Model for the Bay of Keszthely, Lake Balaton,
W80-00712 2L

RHODE ISLAND UNIV., KINGSTON. GRADUATE SCHOOL OF OCEANOGRAPHY.
Unexpected Response to Vitamin B12 of Dominant Centric Diatoms from the Spring Bloom in the Gulf of Maine (Northeast Atlantic Ocean),
W80-00681 5C

RUHRTALSPERRENVEREIN, ESSEN (GERMANY, F.R.).
Examples of the Organization of Self-Administration in the Water Economy of the Federal Republic of Germany,
W80-00470 6E

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. WATER RESOURCES RESEARCH INST.
Petroleum Hydrocarbons in Urban Runoff,
W80-00730 5B

SACLANT ASW RESEARCH CENTRE, LA SPEZIA (ITALY).
Low-Frequency Sea Level and Current Fluctuations Along the Coast of Northwest Italy,
W80-00742 2L

SALFORD UNIV. (ENGLAND). DEPT. OF CIVIL ENGINEERING.
Water Quality in Lentic Water Bodies (Lakes and Reservoirs),
W80-00717 2H

SAN FRANCISCO UNIV., CA. DEPT. OF BIOLOGY.
Uptake, Binding and Clearance of Divalent Cadmium in Glycera Dibranchiata (Annelida: Polychaeta),
W80-00664 5A

SASKATCHEWAN UNIV., SASKATOON. DEPT. OF SOIL SCIENCE.
Measurement of Apparent Electrical Conductivity of Soils by an Electromagnetic Induction Probe to Aid Salinity Surveys,
W80-00750 2G

SCIENCE AND EDUCATION ADMINISTRATION, ATHENS, GA.
An Application Runoff Model Strategy for Ungaged Watersheds,
W80-00728 2E

SCIENCE AND EDUCATION ADMINISTRATION, COLUMBIA, MO. NORTH CENTRAL WATERSHED RESEARCH CENTER.
Impact of Irrigation Water Salinity on Soil Runoff Water and Groundwater in Missouri,
W80-00635 3C

SCIENCE AND EDUCATION ADMINISTRATION, LAFAYETTE, IN.
Influence of Surface Roughness and Clod Size and Stability on Soil and Water Losses,
W80-00593 2J

SCIENCE AND EDUCATION ADMINISTRATION, RIVERSIDE, CA. SALINITY LAB.
Inexpensive Four-Electrode Probe for Monitoring Soil Salinity,
W80-00751 2G

A Compact, Low-Cost Circuit for Reading Four-Electrode Salinity Sensors,
W80-00752 2G

SCIENTIFIC AND EDUCATION ADMINISTRATION, BELTSVILLE, MD. HYDROLOGY LAB.
Secular Trend in Extreme Rainfalls,
W80-00735 2B

SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CA.
Performance Analysis of Tethered Float Breakwater,
W80-00587 8B

SEA ICE CONSULTANTS, CAMP SPRINGS, MD.
Inadequacies in Archived Sea Ice Data,
W80-00577 2C

SHEARWATER FISH FARMING CARLISLE (ENGLAND).
Nephrocalcinosis in Rainbow Trout Salmo Gairdneri Richardson; The Effect of Exposure to Elevated CO2 Concentrations,
W80-00674 5A

SHIMONOSEKI UNIV. OF FISHERIES (JAPAN). DEPT. OF FOOD SCIENCE AND TECHNOLOGY.
Total and Methylmercury Levels in Three Species of Whelks,
W80-00656 5A

SIMON BOLIVAR UNIV., CARACAS (VENEZUELA).
Simulation Analyses: The Detailed Model,
W80-00561 2A

SKIDAWAY INST. OF OCEANOGRAPHY, SAVANNAH, GA.
Degradation of Selected Polycyclic Aromatic Hydrocarbons in Coastal Sediments: Importance of Microbes and Polychaete Worms,
W80-00613 5A

SKIDWAY INST. OF OCEANOGRAPHY, SAVANNAH, GA.
The Concentration and Speciation of Arsenic in Marine Macro-Algae,
W80-00658 5A

SOIL CONSERVATION SERVICE, DENVER, CO.
Landsat-Derived Snow Cover as a Forecast Tool in the Rio Grande Basin in Colorado,
W80-00573 2C

SOIL CONSERVATION SERVICE, ORONO, ME.
Flood Hazard Analyses, Little Ossipee River, Towns of Acton, Newfield and Shapleigh, Maine, York County.
W80-00535 2E

SOIL CONSERVATION SERVICE, WASHINGTON, DC.
Water, Food, and Fiber,
W80-00455 3F

SOUTHAMPTON UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.
Drainage Network Power,
W80-00725 8E

STANFORD UNIV., CA. DEPT. OF CIVIL ENGINEERING.
Modeling Groundwater Flow Fields Containing Point Singularities: A Technique for Singularity Removal,
W80-00609 2F

STANFORD UNIV., PACIFIC GROVE, CA. HOPKINS MARINE STATION.
Toxicity and Pharmacology of Extracts from Dorid Nudibranchs,
W80-00673 5A

STATE UNIV. OF NEW YORK AT BUFFALO. DEPT. OF CIVIL ENGINEERING.
Dye-Vector Flow Visualization--Cooling Water Model,
W80-00586 8B

STATE UNIV. OF NEW YORK AT STONY BROOK. MARINE SCIENCES RESEARCH CENTER.
An Assessment of the Effects of Bathymetric Changes Associated with Sand and Gravel Mining on Tidal Circulation in the Lower Bay of New York Harbor,
W80-00693 2J

The Impact of Dredged Holes on Oxygen Demand in the Lower Bay, New York Harbor,
W80-00694 4C

The Lower Bay Complex,
W80-00695 2J

Textural Properties of Surficial Sediments of Lower Bay of New York Harbor,
W80-00696 2J

STATE UNIV. OF NEW YORK COLL. AT BROCKPORT.
An Analysis of Values for Development of Recreational Policy,
W80-00500 6A

STIRLING UNIV. (SCOTLAND). UNIT OF AQUATIC PATHOBIOLOGY.
The Role of Melano-Macrophage Centres in Iron Storage in Normal and Diseased Fish,
W80-00683 5A

TAHAL CONSULTING ENGINEERS (ISRAEL).
Water Resources Development, and Management Planning in Arid Zones: Case History-Israel,
W80-00457 6A

TECHNICAL UNIV. OF WARSAW (POLAND). DEPT. OF SANITARY ENVIRONMENTAL ENGINEERING.
The Effect of Intense Fertilization on Migration of Nitrogen Compounds in Soil,
W80-00508 5C

Significance of Sorption Properties of Soils in Predicting the Migration of Nitrogen Compounds into Natural Waters,
W80-00510 5C

TECHNICAL UNIV. OF WARSAW (POLAND). INST. OF ENVIRONMENTAL ENGINEERING.
Polish Research Program for System-Oriented Regional Management of Water Resources,
W80-00444 6A

TECHNION--ISRAEL INST. OF TECH., HAIFA. DEPT. OF CIVIL ENGINEERING.
On the Growth of Instabilities in Groundwater Due to Temperature and Salinity Gradients,
W80-00605 2F

TECHNION-ISRAEL INST. OF TECH., HAIFA (ISRAEL). FACULTY OF CIVIL ENGINEERING.
Some Dimensional Considerations in the Unit Hydrograph Theory,
W80-00591 2E

TECHNISCHE HOGESCHOOL TWENTE, ENSCHEDE (NETHERLANDS). DEPT. OF CHEMICAL ENGINEERING.
Trace Analysis of Phosphates in Small Aqueous Volumes,
W80-00589 5A

TECHNISCHE UNIV., DRESDEN (GERMAN D.R.). BEREICH HYDROBIOLOGIE.
New Aspects of the Consideration of Feedback Mechanisms in an Ecological Model of the Pelagic Zone,
W80-00715 2H

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY.
Urban Residential Demand for Water in the United States,
W80-00495 6D

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF BIOLOGY.
Interactive Effects of Salinity, Temperature and Polycyclic Aromatic Hydrocarbons on the Survival and Development Rate of Larvae of the Mud Crab Rhithropanopeus Harrisii,
W80-00790 5A

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF OCEANOGRAPHY.
Chemical Aspects of a Brine Pool at the East Flower Garden Bank, Northwestern Gulf of Mexico,
W80-00626 2K

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF WILDLIFE AND FISHERIES SCIENCES.
Acclimation to Ammonia by Tilapia Aurea,
W80-00653 5A

TOHOKU UNIV., SENDAI (JAPAN). DEPT. OF FISHERIES.
Effects of Artificial Eutrophication on the Metabolism of the Japanese Oyster Crassostrea Gigas,
W80-00792 5B

TOKYO UNIV. (JAPAN). DEPT. OF AGRICULTURAL CHEMISTRY.
Study of Metal Contents of Elasmobranch Fishes: Part I-Metal Concentration in the Muscle Tissues of a Dogfish, Squalus Mitsukurii,
W80-00685 5A

TOKYO UNIV. OF FISHERIES (JAPAN).
Zinc Uptake in Marine Diatoms,
W80-00669 5A

TORONTO UNIV. (ONTARIO). DEPT. OF CHEMICAL ENGINEERING AND APPLIED CHEMISTRY.
Rate Controlling Processes in the Release of Radium-226 from Uranium Mill Tailings, I. Leaching Study,
W80-00600 5B

Rate Controlling Processes in the Release of Radium-226 from Uranium Mill Tailings, II. Kinetic Study,
W80-00601 5B

TORONTO UNIV. (ONTARIO). DEPT. OF CIVIL ENGINEERING.
Screening Objectives and Uncertainties in Water Resources Planning,
W80-00551 6A

TRIANGLE J COUNCIL OF GOVERNMENTS, RESEARCH TRIANGLE PARK, NC.
Individual Non-Urban Wastewater Treatment and Management Alternatives: Task B: Summary of Alternative On-Site Wastewater Treatment and Disposal Methods, Region J, N.C.
W80-00534 5D

TROMOE UNIV. (NORWAY). INST. OF BIOLOGY AND GEOLOGY.
Toxic Effects of Aqueous Extracts of Ekofisk Crude Oil, Crude Oil Fractions, and Commercial Oil Products on the Development of Sea Urchin Eggs,
W80-00798 5A

TRONDHEIM UNIV. (NORWAY).
The Effect of Zinc on the Increase in Length of Five Species of Intertidal Fucales,
W80-00682 5B

TUNIS UNIV. (TUNISIA). DEPT. OF HYDRAULICS.
Relations Between Geometrical Properties of Glass Beads Media and Their Main Psi(Theta) Hysteresis Loops,
W80-00598 2G

UMEA UNIV. (SWEDEN). DEPT. OF BIOLOGY.
The Diatomflora of a Small Stream Near Abisko (Swedish Lapland) and Its Annual Periodicity, Judged by Drift and Colonization,
W80-00516 5C

UMEA UNIV. (SWEDEN). DEPT. OF ECOLOGICAL ZOOLOGY.
Reduction of Aquatic Vegetation Following the Colonization of a Northern Swedish Lake by the Muskrat, Ondatra Zibethica,
W80-00513 5C

UNITED NATIONS ENVIRONMENT PROGRAM, GENEVA (SWITZERLAND).
Environmental Issues in River Basin Development,
W80-00433 2A

UNIVERSITY COLL., DUBLIN (IRELAND). DEPT. OF CIVIL ENGINEERING.
On the Choice of Boundary Conditions for One-Dimensional Models of Estuarine Water Quality,
W80-00706 2L

UNIVERSITY COLL. OF NORTH WALES, BANGOR. SCHOOL OF PLANT BIOLOGY.
A Survey of the Biota, Environment and Use for Recreation of Twelve Lakes in Snowdonia,
W80-00699 5C

UNIVERSITY COLL. OF NORTH WALES, MENAI BRIDGE. MARINE SCIENCES LAB.
Shelf Sea Fronts' Adjustments Revealed by Satellite IR Imagery,
W80-00603 2L

UNIVERSITY OF EAST ANGLIA, NORWICH (ENGLAND). CLIMATE RESEARCH UNIT.
An Arctic Sea Ice Data Set, 1901-1956,
W80-00576 2C

VICTORIA MINISTRY FOR CONSERVATION, MELBOURNE (AUSTRALIA).
Biogeochemistry of Selected Heavy Metals in Western Port, Victoria, and Use of Invertebrates as Indicators with Emphasis on Mytilus Edulis Planulatus,
W80-00788 5A

VICTORIA MINISTRY FOR CONSERVATION, MELBOURNE (AUSTRALIA). MARINE POLLUTION STUDIES GROUP.
Acute Toxicity of Copper, Cadmium and Zinc to Three Species of Marine Copepod,
W80-00679 5A

VICTORIA UNIV. OF MANCHESTER (ENGLAND). GEOGRAPHY DIV.
An Analysis of the Processes of River Bank Erosion,
W80-00612 2J

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF AGRONOMY.
Physical Condition of a Davidson Clay Loam after Five Years of Heavy Poultry Manure Applications,
W80-00620 2G

VSESOYUZNYI NAUCHNO-ISSLEDOVATELSKII INST. VODOSNABZHENIYA, KANALIZATSII, GIDROTEKHNICHESKIKH SOORUZHENII I INZHENERNOI GIDROGEOLOGII, MOSCOW (USSR).
Main Trends in Treatment of Municipal and Industrial Sewage in the USSR,
W80-00464 5D

VYZKUMNY USTAV VODOHOSPODARSKY, BRATISLAVA (CZECHOSLOVAKIA).
Computation of the Advancement of Groundwater Pollution Due to Petroleum Products Originating from a Known Source of Contamination (Le Calcul de la Propagation de la Pollution des Eaux Souterraines par des Materiaux Huileux, Provenants D'une Source de la Pollution Connue),
W80-00720 5B

WARSAW UNIV. (POLAND). CHAIR OF HYDROBIOLOGY.
Can Planktovorous Fish Keep in Check Planktonic Crustacean Populations. A Test of Size-Efficiency Hypothesis in Typical Polish Lakes,
W80-00505 5C

WASHINGTON STATE WATER RESEARCH CENTER, PULLMAN.
Summary: Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00633 6G

Social, Economic, and Institutional Aspects of Wildlife Enhancement in Irrigated Agriculture: A Study of the Columbia Basin Irrigation Project,
W80-00634 6G

WASHINGTON UNIV., SEATTLE. DEPT. OF GEOLOGICAL SCIENCES.
Sediment Yield and Land Use in Tropical Catchments,
W80-00746 2J

WASHINGTON UNIV., SEATTLE, DEPT. OF OCEANOGRAPHY.
On the Generation of the Seasonal Coastal Upwelling in the Gulf of Guinea,
W80-00608 2L

Upwelling and Estuary Flushing,
W80-00632 2L

Turbulent Flow in a Depth-Limited Boundary Layer,
W80-00741 8B

WATER AND AIR RESEARCH, INC., GAINESVILLE, FL.
Dividing-Flow Manifolds with Square-Edged Laterals,
W80-00582 8B

WATER POLLUTION RESEARCH LAB., STEVENAGE (ENGLAND).
The Survival of Smolts of Salmon Salmo Salar L. at Low Concentrations of Dissolved Oxygen,
W80-00655 5A

WATER RESOURCES COMMISSION, SIDNEY (AUSTRALIA).
The Response of Groundwater Systems to Drought,
W80-00462 4B

WATERLOO UNIV. (ONTARIO) DEPARTMENT OF CIVIL ENGINEERING.
Simulation Analyses: The Basic Model,
W80-00560 6A

WESTINGHOUSE ELECTRIC CORP., BALTIMORE, MD.
A DMSP Near IR Sensor for Cloud/Snow Discrimination,
W80-00570 7B

WISCONSIN UNIV.-MADISON. DEPT. OF ENTOMOLOGY.
Metabolism of Toxaphene by Aquatic Sediment and a Camphor-Degrading Pseudomonad,
W80-00511 5C

WISCONSIN UNIV., MADISON. DEPT. OF SOIL SCIENCE.
Sediment and Nutrient Yield from Residential Construction Sites,
W80-00622 5B

WISCONSIN UNIV.-MADISON. LAB. OF LIMNOLOGY.
Growth Rates and Temperature Selection of Bluegill, Lepomis Macrochirus,
W80-00654 5C

WOLLONGONG UNIV. (AUSTRALIA). DEPT. OF CIVIL ENGINEERING.
A Storage Routing Model Based on Catchment Geomorphology,
W80-00590 2E

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MA.
Laboratory Simulation of the Gyre in the Alboran Sea,
W80-00743 2L

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MA. DEPT. OF BIOLOGY.
Growth and Competition of the Marine Diatoms Phaeodactylum Tricornutum and Thalassiosira Pseudonana, I. Nutrient Effects,
W80-00515 5C

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MA. DEPT. OF CHEMISTRY.
Isotopic Composition of River Runoff on the U.S. East Coast: Evaluation of Stable Isotope Versus Salinity Plots for Coastal Water Mass Identification,
W80-00607 2L

WORLD HEALTH ORGANIZATION, GENEVA (SWITZERLAND).
Report on Community Water Supplies,
W80-00427 5F

WORLD METEOROLOGICAL ORGANIZATION, GENEVA (SWITZERLAND).
The Promise of Technology: Potential and Limitations. Part Two,
W80-00403 6A

Assessment of Water Resources: Networks, Surveys, Services, and Related Facilities: Present Status and Requirements by 2000.
W80-00426 6A

ACCESSION NUMBER INDEX

W80-00401 6A
W80-00402 6A
W80-00403 6A
W80-00404 6A
W80-00405 6A
W80-00406 6A
W80-00407 6A
W80-00408 6A
W80-00409 6A
W80-00410 6A
W80-00411 6C
W80-00412 6C
W80-00413 6A
W80-00414 6B
W80-00415 6A
W80-00416 6A
W80-00417 5C
W80-00418 6A
W80-00419 6A
W80-00420 5D
W80-00421 4A
W80-00422 2A
W80-00423 6E
W80-00424 4A
W80-00425 6E
W80-00426 6A
W80-00427 5F
W80-00428 6E
W80-00429 3C
W80-00430 6A
W80-00431 6E
W80-00432 6A
W80-00433 2A
W80-00434 6A
W80-00435 6A
W80-00436 6B
W80-00437 6A
W80-00438 6A
W80-00439 6A
W80-00440 6B
W80-00441 6A
W80-00442 6C
W80-00443 6E
W80-00444 6A
W80-00445 4A
W80-00446 5C
W80-00447 4A
W80-00448 6D
W80-00449 6A
W80-00450 6A
W80-00451 6A
W80-00452 6A
W80-00453 6A
W80-00454 6E
W80-00455 3F
W80-00456 5G
W80-00457 6A
W80-00458 5G
W80-00459 6F
W80-00460 6E
W80-00461 6E
W80-00462 4B
W80-00463 4B
W80-00464 5D
W80-00465 6E
W80-00466 2A
W80-00467 2E
W80-00468 2A
W80-00469 4A
W80-00470 6E
W80-00471 6E
W80-00472 6A
W80-00473 6E
W80-00474 7A
W80-00475 7B
W80-00476 6E
W80-00477 6F
W80-00478 6E
W80-00479 2B
W80-00480 6E
W80-00481 3F
W80-00482 3C
W80-00483 6D
W80-00484 5G
W80-00485
W80-00486 6E
W80-00487 3A
W80-00488 2H
W80-00489 5G
W80-00490 2F
W80-00491 2E
W80-00492 6B
W80-00493 5D
W80-00494 6D
W80-00495 6D
W80-00496 6E
W80-00497 3C
W80-00498 5C
W80-00499 6D
W80-00500 6A
W80-00501 8A
W80-00502 5C
W80-00503 5C
W80-00504 5C
W80-00505 5C
W80-00506 5C
W80-00507 5C
W80-00508 5C
W80-00509 5C
W80-00510 5C
W80-00511 5C
W80-00512 5C
W80-00513 5C
W80-00514 5C
W80-00515 5C
W80-00516 5C
W80-00517 5C
W80-00518 5C
W80-00519 5C
W80-00520 5C
W80-00521 5C
W80-00522 5C
W80-00523 5C
W80-00524 6E
W80-00525 5B
W80-00526 6E
W80-00527 6E
W80-00528 6G
W80-00529 5E
W80-00530 2F
W80-00531 6E
W80-00532 6E
W80-00533 6D
W80-00534 5D
W80-00535 2E
W80-00536 2E
W80-00537 2E
W80-00538 2E
W80-00539 2E
W80-00540 2E
W80-00541 2E
W80-00542 6B
W80-00543 6D
W80-00544 5D
W80-00545 6E
W80-00546 6E
W80-00547 4C
W80-00548 6E
W80-00549 6B
W80-00550 6B
W80-00551 6A
W80-00552 5A
W80-00553 2L
W80-00554 6A
W80-00555 6A
W80-00556 6A
W80-00557 6A
W80-00558 6A
W80-00559 6A
W80-00560 6A
W80-00561 2A
W80-00562 6A
W80-00563 6B
W80-00564 6B
W80-00565 6A
W80-00566 2C
W80-00567 2C
W80-00568 2C
W80-00569 7C
W80-00570 7B
W80-00571 7B
W80-00572 7B
W80-00573 2C
W80-00574 2C
W80-00575 2C
W80-00576 2C
W80-00577 2C
W80-00578 7C
W80-00579 5B
W80-00580 2H
W80-00581 5A
W80-00582 8B
W80-00583 4A
W80-00584 5E
W80-00585 2E
W80-00586 8B
W80-00587 8B
W80-00588 2J
W80-00589 5A
W80-00590 2E
W80-00591 2E
W80-00592 2G
W80-00593 2J
W80-00594 2J
W80-00595 3F
W80-00596 2G
W80-00597 2G
W80-00598 2G
W80-00599 6D
W80-00600 5B
W80-00601 5B
W80-00602 2B
W80-00603 2L
W80-00604 2F
W80-00605 2F
W80-00606 2A
W80-00607 2L
W80-00608 2L
W80-00609 2F
W80-00610 2F
W80-00611 2E
W80-00612 2J
W80-00613 5A
W80-00614 2G
W80-00615 2G
W80-00616 2K
W80-00617 5A
W80-00618 5A
W80-00619 5A
W80-00620 2G
W80-00621 5B
W80-00622 5B
W80-00623 5A
W80-00624 2K
W80-00625 5A
W80-00626 2K
W80-00627 2L
W80-00628 2L
W80-00629 2H
W80-00630 2L
W80-00631 2H
W80-00632 2L
W80-00633 6G
W80-00634 6G
W80-00635 3C
W80-00636 6B
W80-00637 6G
W80-00638 5C
W80-00639 6B
W80-00640 6G
W80-00641 3F
W80-00642 5F
W80-00643 6B
W80-00644 6D
W80-00645 7B
W80-00646 6B
W80-00647 6B
W80-00648 3D
W80-00649 5A
W80-00650 5C
W80-00651 5A
W80-00652 5C
W80-00653 5A
W80-00654 5C
W80-00655 5A
W80-00656 5A
W80-00657 5A
W80-00658 5A
W80-00659 5A
W80-00660 5A
W80-00661 5A
W80-00662 5A
W80-00663 5A
W80-00664 5A
W80-00665 5A
W80-00666 5A
W80-00667 5A
W80-00668 5A
W80-00669 5A
W80-00670 5A
W80-00671 5B
W80-00672 5A
W80-00673 5A
W80-00674 5A
W80-00675 5B
W80-00676 5A
W80-00677 5B
W80-00678 5A
W80-00679 5A
W80-00680 5A
W80-00681 5C
W80-00682 5B
W80-00683 5A
W80-00684 5A
W80-00685 5A
W80-00686 5C
W80-00687 5A
W80-00688 5A
W80-00689 5C
W80-00690 5C
W80-00691 2E
W80-00692 5C
W80-00693 2J
W80-00694 4C
W80-00695 2J
W80-00696 2J
W80-00697 5C
W80-00698 2B
W80-00699 5C
W80-00700 5B
W80-00701 5B
W80-00702 5B
W80-00703 2A
W80-00704 5B
W80-00705 2A
W80-00706 2L
W80-00707 5B
W80-00708 5B
W80-00709 2A
W80-00710 2L
W80-00711 2L
W80-00712 2L
W80-00713 2L
W80-00714 2D
W80-00715 2H
W80-00716 2H
W80-00717 2H
W80-00718 2H
W80-00719 5B
W80-00720 5B
W80-00721 5A
W80-00722 7C
W80-00723 2H
W80-00724 2E
W80-00725 8E
W80-00726 2F
W80-00727 2F
W80-00728 2E
W80-00729 2E
W80-00730 5B
W80-00731 2E
W80-00732 2D
W80-00733 2G
W80-00734 2L
W80-00735 2B
W80-00736 2B

W80-00737	2L
W80-00738	2C
W80-00739	2C
W80-00740	2L
W80-00741	8B
W80-00742	2L
W80-00743	2L
W80-00744	2I
W80-00745	2E
W80-00746	2J
W80-00747	2E
W80-00748	2E
W80-00749	2E
W80-00750	2G
W80-00751	2G
W80-00752	2G
W80-00753	2G
W80-00754	2G
W80-00755	2I
W80-00756	6A
W80-00757	5B
W80-00758	2E
W80-00759	2A
W80-00760	2E
W80-00761	5B
W80-00762	2E
W80-00763	4B
W80-00764	4D
W80-00765	7C
W80-00766	2H
W80-00767	5B
W80-00768	4B
W80-00769	4C
W80-00770	4B
W80-00771	2E
W80-00772	4C
W80-00773	5B
W80-00774	6A
W80-00775	5E
W80-00776	7A
W80-00777	7C
W80-00778	7C
W80-00779	7C
W80-00780	7C
W80-00781	5C
W80-00782	5A
W80-00783	5A
W80-00784	5A
W80-00785	5A
W80-00786	5A
W80-00787	5A
W80-00788	5A
W80-00789	5A
W80-00790	5A
W80-00791	5B
W80-00792	5B
W80-00793	5A
W80-00794	5A
W80-00795	5A
W80-00796	5A
W80-00797	5A
W80-00798	5A
W80-00799	5A
W80-00800	5C

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Cornell University, Policy Models for Water Resources Systems	W80-00551 00554--00565 00583, 00599	15
Illinois State Water Survey, Hydrology	W80-00566--00582 00584--00598 00600--00632 00700--00755	121
University of Arizona, Arid Land Water Resources	W80-00639--00648	10
University of N. Carolina, Metropolitan Water Resources Planning and Management	W80-00524--00550 00552--00553	29
University of Wisconsin, Eutrophication	W80-00417, 00446 00456, 00458 00460 00463--00464 00484 00502--00523 00638, 00681 00699, 00781	34
University of Wisconsin, Water Resources Economics	W80-00401--00405 00425--00432 00434--00438 00442--00444 00447--00454 00457, 00459 00465--00468 00472--00473 00476, 00481 00483 00485--00486 00494--00499	48

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W80-00488--00493 00635--00637 00691	10
C. OTHER		
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W80-00649--00680 00682--00690 00782--00800	60
National Oceanic and Atmospheric Administration	W80-00692--00698	7
Office of Water Research and Technology	W80-00487 00633--00634	3
U. S. Geological Survey	W80-00756--00780	25

☆U.S. GOVERNMENT PRINTING OFFICE: 1980-311-059/17

TOTAL
10
60
7
3
25